

**REFINEMENT OF  
CENRAP'S 2002 EMISSIONS INVENTORIES  
(SCHEDULE 9; WORK ITEM 3)**

**FINAL**

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## ACRONYMS AND ABBREVIATIONS

|                   |   |
|-------------------|---|
| CAP               | criteria air pollutant  |
| CE                | Control Equipment (NIF 3.0 table)   |
| CENRAP            | Central Regional Air Planning Association   |
| CMU               | Carnegie Mellon University  |
| CO                | carbon monoxide   |
| CO <sub>2</sub>   | carbon dioxide  |
| EF                | emission factor   |
| EFIG              | Emission Factor and Inventory Group   |
| EI                | Emission Inventory  |
| EM                | Emission (NIF 3.0 table)  |
| EP                | Emission Process (NIF 3.0 table)  |
| EPM               | Emission Production Model   |
| EPA               | U.S. Environmental Protection Agency  |
| ER                | Emission Release Point (NIF 3.0 table)  |
| ERP               | Emission Release Point (NIF 3.0 field in ER table)  |
| EU                | Emission Unit (NIF 3.0 table)   |
| FIPS              | Federal Information Processing Standard   |
| FIRE              | Factor Information and REtrieval  |
| GIS               | geographic information system   |
| HAP               | hazardous air pollutant   |
| ID                | identification  |
| IDA               | Inventory Data Analyzer format  |
| IPM               | Integrated Planning Model   |
| LPG               | liquefied petroleum gas   |
| MACT              | maximum achievable control technology   |
| NAAQS             | National Ambient Air Quality Standard   |
| NEI               | National Emissions Inventory  |
| NH <sub>3</sub>   | ammonia   |
| NIF 3.0           | NEI Input Format Version 3.0  |
| NO <sub>x</sub>   | oxides of nitrogen  |
| ORIS              | Office of Regulatory Information Systems  |
| PD                | primary device  |
| PE                | Emission Period (NIF 3.0 table)   |
| Pechan            | E.H. Pechan & Associates, Inc.  |
| PM                | particulate matter  |
| PM <sub>10</sub>  | particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers  |
| PM10-FIL          | filterable PM <sub>10</sub>   |
| PM10-PRI          | primary PM <sub>10</sub>  |
| PM <sub>2.5</sub> | particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers |
| PM25-FIL          | filterable PM <sub>2.5</sub>  |
| PM25-PRI          | primary PM <sub>2.5</sub>   |
| PMC               | coarse PM   |
| PM-CON            | condensible PM  |
| ppm               | parts per million   |
| QA                | quality assurance   |
| QAPP              | Quality Assurance Project Plan  |

|                 |  |
|-----------------|--|
| RPO             | Regional Planning Organization                                       |
| SCC             | Source Classification Code   |
| SD              | secondary device   |
| SI              | Site (NIF 3.0 table)   |
| SIC             | Standard Industrial Classification                                   |
| SIP             | State Implementation Plan  |
| S/L/T           | State, Local, and Tribal   |
| SMOKE           | Sparse Matrix Operator Kernel Emissions                              |
| SO <sub>2</sub> | sulfur dioxide   |
| TOG             | total organic gases  |
| TR              | Transmittal (NIF 3.0 table)  |
| U.S.            | United States  |
| VISTAS          | Visibility Improvement State and Tribal Association of the Southeast |
| VOC             | volatile organic compound  |

## I. INTRODUCTION

### A. Overview

This report documents the data sources, methods, and results for updating the 2002 base year criteria air pollutant (CAP) and ammonia (NH<sub>3</sub>) emissions inventories for point, area, and nonroad sources for the Central Regional Air Planning Association (CENRAP) Regional Planning Organization (RPO). The “Base A” 2002 inventory files completed during February 2005 were updated to incorporate comments provided by the CENRAP State, Local, and Tribal (S/L/T) agencies and the Emissions Inventory (EI) and Modeling Workgroups. As a result of the updates, the new inventory files are termed “Base B”. Additional work completed under this work order include the development of Sparse Matrix Operator Kernel Emissions/Inventory Data Analyzer (SMOKE/IDA) input files for a 2018 projection year inventory for electricity generating units (EGUs) and for fires that occurred in Ontario during 2002.

The CENRAP region includes the states and tribal jurisdictions of Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, Oklahoma, and Texas. CENRAP (and other RPOs) will use these inventories to support air quality modeling, State Implementation Plan (SIP) development, and implementation activities for the regional haze rule and fine particulate matter (PM) and ozone National Ambient Air Quality Standards (NAAQS).

The inventories and supporting data prepared include the following:

- (1) Comprehensive, county-level, mass emissions and modeling inventories for point, area, and nonroad sources of 2002 emissions for the CAPs and NH<sub>3</sub> for the S/L/T agencies included in the CENRAP region;
- (2) Modeling inventory files containing 2018 projection year emissions for EGUs; and
- (3) A modeling inventory for Ontario fires during 2002.

The mass emissions inventory files were prepared in the National Emissions Inventory (NEI) Input Format Version 3.0 (NIF 3.0). The modeling inventory files were prepared in the SMOKE/IDA format. The revisions to the Base A point, area, and nonroad inventories did not result in adding any new SCCs that were not already included in the temporal, speciation, and spatial allocation profiles for the CENRAP inventories. Therefore, there were no revisions to the ancillary files containing the spatial, temporal, and speciation profile data.

The inventories include annual emissions for sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), volatile organic compounds (VOC), carbon monoxide (CO), NH<sub>3</sub>, and particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., primary PM<sub>10</sub> and PM<sub>2.5</sub>). The inventories included summer day, winter day, and average day emissions. However, not all agencies included daily emissions in their inventories, and, for the agencies that did, the temporal basis for the daily emissions varied between agencies. Consequently, the inventories did not contain a complete and consistent set of daily emissions for all source categories and pollutants. Therefore, daily emissions prepared by S/L/T agencies were maintained in the NIF files if they met quality assurance (QA) review requirements. However, CENRAP requested that the daily emissions not be included in the SMOKE input files. The

temporal profiles prepared for this project will be used to calculate daily emissions. If needed, the daily emissions prepared by the agencies may be retrieved from the NIF database files.

The following data sources were used to update CENRAP's Base A inventories:

- (1) S/L/T agency comments on the "Base A" inventories;
- (2) S/L/T agency comments on the draft 2002 NEI;
- (3) Revisions to CENRAP-sponsored inventories; and
- (4) Comments from CENRAP's EI and Modeling Workgroups.

The United States (U.S.) Environmental Protection Agency's (EPA's) format and content QA programs (and other QA checks not included in EPA's QA software) were run on each inventory to identify format and/or data content issues (EPA, 2004a). E.H. Pechan & Associates, Inc. (Pechan) worked with the CENRAP's EI and Modeling Workgroups and the S/L/T agencies to resolve QA issues and augment the inventories to fill data gaps in accordance with the Methods Plan and Quality Assurance Project Plan (QAPP) prepared for this project (CENRAP, 2005a; CENRAP, 2005b). The EI Workgroup and S/L/T agencies reviewed the draft inventory files after updating the inventories, and the files were updated to address their comments.

## **B. Summary of the 2002 Base Year Inventories**

This section of the report provides a brief summary of the consolidated 2002 Base B inventories for the CENRAP region. Table 1 shows total annual emissions for CAPs and NH<sub>3</sub> for point, area, nonroad, and onroad sources. The sector contributing the highest emissions varies by pollutant. Point sources account for the highest percentage of total NO<sub>x</sub> (35 percent) and SO<sub>2</sub> (83 percent) emissions. Area sources account for the highest percentage of total VOC (44 percent), primary PM<sub>10</sub> (PM10-PRI (93 percent)), primary PM<sub>2.5</sub> (PM25-PRI (81 percent)), and NH<sub>3</sub> (83.5 percent) emissions. Onroad sources account for the highest percentage of CO (57 percent) emissions. Onroad sources account for 24.5 percent and nonroad sources account for 17 percent of total VOC emissions. Onroad sources account for 33 percent and nonroad sources account for 18.5 percent of total NO<sub>x</sub> emissions.

Table 2a shows total annual emissions by state and pollutant for all four sectors combined. Tables 2b through 2e show total annual emissions by state and pollutant for area, point, nonroad, and onroad sources, respectively. Tables A-1 through A-6 in Appendix A provide summaries of annual emissions by source category and sector for VOC, NO<sub>x</sub>, CO, SO<sub>2</sub>, PM10-PRI and PM25-PRI, and NH<sub>3</sub>, respectively. The emissions in each table are sorted in descending order with the highest emitting categories listed at the top of the table. The tables also show annual emissions as a percentage of total emissions from all sectors, and the cumulative percentage contribution. Chapter III of this report identifies additional summaries of emissions, including county-level summaries that contain the data source codes that identify the origin and year of emissions data.

The Fond du Lac Band of the Minnesota Chippewa Tribe and the Leech Lake Band of Ojibwe Tribe each provided point and area source inventories. The point source inventories are included in the Base B inventory; however, the area source inventories are not because SMOKE is not currently programmed to process tribal area source data. Thus, the tribal area source inventories



are included in a separate NIF 3.0 database and the area source emissions are summarized in Table 2f (note that these area source emissions are not included in Tables 1, 2a, and 2b).

The nonroad Base B inventory includes carbon dioxide (CO<sub>2</sub>) emissions, the point source inventory includes total primary and filterable particulate matter (PM-PRI/-FIL) emissions, and the point and area source inventories include filterable PM<sub>10</sub> (PM10-FIL), filterable PM<sub>2.5</sub> (PM25-FIL), and condensible PM (PM-CON) emissions. The emissions for these pollutants were carried in the mass emissions inventory files. However, these pollutants are not included in the summaries since the emissions for these pollutants were not consistently reported by all S/L/T agencies for a given sector. In addition, AR is the only state that included PM10-PRI and PM25-PRI emissions for fugitive wind-blown dust emissions in its area source inventory. The wind-blown dust emissions are stored in the area miscellaneous sources inventory, and are included in the sector-level summaries (as geogenic and natural/biogenic sources) described in Chapter III of this report.

### **C. Organization of the Report**

In Chapter II of this report, section A provides an introduction to the chapter and sections B through D present the data sources and methods applied to prepare the mass emissions inventory and SMOKE input files for point, area, and nonroad sources within the CENRAP region. Section E explains the data sources and methods applied to prepare SMOKE IDA files for a 2018 projection year inventory for electricity generating units (EGUs) in the CENRAP region. Section F provides documentation of the SMOKE and RPO data exchange protocol files prepared under this project.

Chapter III and Appendix A provide summaries of the 2002 emissions inventories for point, area, nonroad, and onroad sources within the CENRAP region. Chapter IV presents the data sources and methods applied to prepare SMOKE input files for 2002 fires in Ontario, Canada. Chapter V provides the references for this report.

### **D. Project Work Plan and Methods Document**

At the beginning of this project, a draft work plan and methods document was prepared and reviewed by the CENRAP EI and Modeling Workgroups (CENRAP, 2005a; CENRAP, 2005c). The Workgroups did not provide any comments on these two deliverables. Thus, the draft work plan and methods document was not revised. However, during the duration of the project, the Workgroups requested additional revisions to the Base A point, area, and nonroad inventories after the draft work plan and methods document was prepared and reviewed by the Workgroups. This final report for the Base B inventory details all of the updates and refinements completed on the Base A inventory. However, due to time and resource constraints, the draft work plan and methods document was not revised to reflect this additional work.

**Table 1. Summary of Annual Emissions for the CENRAP Region by Sector and Pollutant**

| Sector                             | VOC              |                  | NO <sub>x</sub>  |                  | CO                |                  | SO <sub>2</sub>  |                  | PM10-PRI         |                  | PM25-PRI         |                  | NH <sub>3</sub>  |                  |
|------------------------------------|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                                    | Tons/Year        | Percent of Total | Tons/Year        | Percent of Total | Tons/Year         | Percent of Total | Tons/Year        | Percent of Total | Tons/Year        | Percent of Total | Tons/Year        | Percent of Total | Tons/Year        | Percent of Total |
| Point                              | 532,229          | 14.0             | 1,825,128        | 35.1             | 1,761,327         | 7.8              | 2,222,998        | 82.7             | 375,842          | 4.9              | 233,070          | 12.7             | 194,467          | 11.1             |
| Area                               | 1,680,228        | 44.2             | 679,931          | 13.1             | 3,617,995         | 16.1             | 321,222          | 12.0             | 7,100,109        | 93.1             | 1,498,076        | 81.3             | 1,466,292        | 83.5             |
| Nonroad                            | 659,316          | 17.3             | 964,071          | 18.5             | 4,340,598         | 19.3             | 95,304           | 3.6              | 82,916           | 1.1              | 76,798           | 4.2              | 1,365            | 0.1              |
| Onroad                             | 930,704          | 24.5             | 1,735,738        | 33.4             | 12,782,810        | 56.8             | 47,644           | 1.8              | 37,649           | 0.5              | 27,231           | 1.5              | 50,317           | 2.9              |
| Natural Sources                    | 0                | 0.0              | 0                | 0.0              | 0                 | 0.0              | 0                | 0.0              | 0                | 0.0              | 0                | 0.0              | 44,688           | 2.5              |
| Geogenic                           | 0                | 0.0              | 0                | 0.0              | 0                 | 0.0              | 0                | 0.0              | 32,164           | 0.4              | 7,076            | 0.4              | 0                | 0.0              |
| <b>Totals</b>                      | <b>3,802,477</b> | <b>100</b>       | <b>5,204,868</b> | <b>100</b>       | <b>22,502,730</b> | <b>100</b>       | <b>2,687,169</b> | <b>100</b>       | <b>7,628,680</b> | <b>100</b>       | <b>1,842,252</b> | <b>100</b>       | <b>1,757,129</b> | <b>100</b>       |
| <b>Dominant Sector<sup>1</sup></b> | <b>Area</b>      |                  | <b>Point</b>     |                  | <b>Onroad</b>     |                  | <b>Point</b>     |                  | <b>Area</b>      |                  | <b>Area</b>      |                  | <b>Area</b>      |                  |

<sup>1</sup> Identifies the sector accounting for the majority of the emissions for each pollutant.

**Table 2a. Summary of All Sector Source Emissions by State and Pollutant**

| State FIPS/<br>Tribal Code | State/Tribal Name         | VOC              |                  | NO <sub>x</sub>  |                  | CO                |                  | SO <sub>2</sub>  |                  | PM10-PRI         |                  | PM25-PRI         |                  | NH <sub>3</sub>  |                  |
|----------------------------|---------------------------|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                            |                           | Tons/ Year       | Percent of Total | Tons/ Year       | Percent of Total | Tons/ Year        | Percent of Total | Tons/ Year       | Percent of Total | Tons/ Year       | Percent of Total | Tons/ Year       | Percent of Total | Tons/ Year       | Percent of Total |
| 05                         | Arkansas                  | 272,607          | 7.2              | 298,625          | 5.7              | 1,445,276         | 6.4              | 128,033          | 4.8              | 292,586          | 3.9              | 100,826          | 5.5              | 145,323          | 8.5              |
| 19                         | Iowa                      | 284,276          | 7.5              | 331,391          | 6.4              | 1,613,636         | 7.2              | 199,941          | 7.4              | 517,601          | 6.8              | 121,979          | 6.7              | 250,688          | 14.6             |
| 20                         | Kansas                    | 261,263          | 6.9              | 381,986          | 7.3              | 2,176,490         | 9.7              | 165,373          | 6.2              | 783,815          | 10.3             | 227,308          | 12.4             | 181,081          | 10.6             |
| 22                         | Louisiana                 | 385,686          | 10.1             | 707,068          | 13.6             | 2,330,169         | 10.4             | 391,312          | 14.6             | 333,116          | 4.4              | 157,745          | 8.6              | 85,593           | 5.0              |
| 27                         | Minnesota                 | 396,648          | 10.4             | 487,033          | 9.4              | 2,531,648         | 11.3             | 158,555          | 5.9              | 826,338          | 10.9             | 196,427          | 10.7             | 179,814          | 10.5             |
| 29                         | Missouri                  | 387,390          | 10.2             | 488,085          | 9.4              | 2,607,987         | 11.6             | 424,088          | 15.8             | 1,000,608        | 13.2             | 208,035          | 11.3             | 157,003          | 9.2              |
| 31                         | Nebraska                  | 142,037          | 3.7              | 255,060          | 4.9              | 870,962           | 3.9              | 94,069           | 3.5              | 469,576          | 6.2              | 96,205           | 5.2              | 169,810          | 9.9              |
| 40                         | Oklahoma                  | 388,347          | 10.2             | 466,748          | 9.0              | 2,222,719         | 9.9              | 170,113          | 6.3              | 740,953          | 9.8              | 174,044          | 9.5              | 133,558          | 7.8              |
| 48                         | Texas                     | 1,284,200        | 33.8             | 1,787,975        | 34.4             | 6,702,571         | 29.8             | 955,686          | 35.6             | 2,631,794        | 34.6             | 552,511          | 30.1             | 409,564          | 23.9             |
| 405                        | Fond du Lac Tribe         | 3                | 0.0              | 501              | 0.0              | 129               | 0.0              | 0                | 0.0              | 8                | 0.0              | 8                | 0.0              | 0                | 0.0              |
| 407                        | Leech Lake Band of Ojibwe | 18               | 0.0              | 397              | 0.0              | 1,145             | 0.0              | 0                | 0.0              | 121              | 0.0              | 88               | 0.0              | 4                | 0.0              |
|                            | <b>Totals<sup>1</sup></b> | <b>3,802,477</b> | <b>100</b>       | <b>5,204,868</b> | <b>100</b>       | <b>22,502,730</b> | <b>100</b>       | <b>2,687,169</b> | <b>100</b>       | <b>7,596,517</b> | <b>100</b>       | <b>1,835,175</b> | <b>100</b>       | <b>1,712,437</b> | <b>100</b>       |

<sup>1</sup> PM10-PRI and PM25-PRI emissions from biogenic sources and NH<sub>3</sub> emissions from natural sources are not included in the area source emissions totals shown in this table.

**Table 2b. Summary of Area Source Emissions by State and Pollutant**

| State FIPS/<br>Tribal Code | State/Tribal Name   | VOC        |                  | NO <sub>x</sub> |                  | CO         |                  | SO <sub>2</sub> |                  | PM10-PRI   |                  | PM25-PRI   |                  | NH <sub>3</sub> |                  |
|----------------------------|---------------------|------------|------------------|-----------------|------------------|------------|------------------|-----------------|------------------|------------|------------------|------------|------------------|-----------------|------------------|
|                            |                     | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total |
| 05                         | Arkansas            | 71,371     | 4.3              | 25,392          | 3.7              | 145,859    | 4.0              | 27,873          | 8.7              | 243,378    | 3.4              | 61,352     | 4.1              | 139,882         | 9.5              |
| 19                         | Iowa                | 105,563    | 6.3              | 6,920           | 1.0              | 102,183    | 2.8              | 3,290           | 1.0              | 477,093    | 6.7              | 97,987     | 6.5              | 244,446         | 16.7             |
| 20                         | Kansas              | 137,821    | 8.2              | 43,114          | 6.3              | 875,433    | 24.2             | 14,084          | 4.4              | 728,377    | 10.3             | 194,959    | 13.0             | 114,482         | 7.8              |
| 22                         | Louisiana           | 113,241    | 6.7              | 99,060          | 14.6             | 530,135    | 14.7             | 83,253          | 25.9             | 245,162    | 3.5              | 84,068     | 5.6              | 71,756          | 4.9              |
| 27                         | Minnesota           | 169,918    | 10.1             | 59,536          | 8.8              | 276,964    | 7.7              | 15,550          | 4.8              | 762,279    | 10.7             | 157,752    | 10.5             | 145,736         | 9.9              |
| 29                         | Missouri            | 133,784    | 8.0              | 34,749          | 5.1              | 269,007    | 7.4              | 48,317          | 15.0             | 962,807    | 13.6             | 182,266    | 12.2             | 120,341         | 8.2              |
| 31                         | Nebraska            | 66,769     | 4.0              | 15,023          | 2.2              | 81,169     | 2.2              | 7,748           | 2.4              | 447,703    | 6.3              | 83,852     | 5.6              | 137,406         | 9.4              |
| 40                         | Oklahoma            | 201,758    | 12.0             | 115,788         | 17.0             | 465,631    | 12.9             | 11,779          | 3.7              | 714,805    | 10.1             | 157,444    | 10.5             | 104,587         | 7.1              |
| 48                         | Texas               | 680,004    | 40.5             | 280,349         | 41.2             | 871,616    | 24.1             | 109,329         | 34.0             | 2,518,505  | 35.5             | 478,396    | 31.9             | 387,657         | 26.4             |
|                            | Totals <sup>1</sup> | 1,680,228  | 100              | 679,931         | 100              | 3,617,995  | 100              | 321,222         | 100              | 7,100,109  | 100              | 1,498,076  | 100              | 1,466,292       | 100              |

<sup>1</sup> PM10-PRI and PM25-PRI emissions from biogenic sources and NH<sub>3</sub> emissions from natural sources are not included in the area source emissions totals shown in this table.

**Table 2c. Summary of Point Source Emissions by State and Pollutant**

| State FIPS/<br>Tribal Code | State/Tribal Name         | VOC        |                  | NO <sub>x</sub> |                  | CO         |                  | SO <sub>2</sub> |                  | PM10-PRI   |                  | PM25-PRI   |                  | NH <sub>3</sub> |                  |
|----------------------------|---------------------------|------------|------------------|-----------------|------------------|------------|------------------|-----------------|------------------|------------|------------------|------------|------------------|-----------------|------------------|
|                            |                           | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total |
| 05                         | Arkansas                  | 102,508    | 19.3             | 68,867          | 3.8              | 357,578    | 20.3             | 90,769          | 4.1              | 39,983     | 10.6             | 31,467     | 13.5             | 2,911           | 1.5              |
| 19                         | Iowa                      | 39,156     | 7.4              | 122,124         | 6.7              | 51,236     | 2.9              | 184,664         | 8.3              | 28,788     | 7.7              | 13,650     | 5.9              | 3,366           | 1.7              |
| 20                         | Kansas                    | 27,458     | 5.2              | 165,284         | 9.1              | 83,307     | 4.7              | 140,371         | 6.3              | 47,081     | 12.5             | 25,073     | 10.8             | 63,914          | 32.9             |
| 22                         | Louisiana                 | 89,025     | 16.7             | 312,634         | 17.1             | 285,395    | 16.2             | 286,050         | 12.9             | 73,333     | 19.5             | 60,899     | 26.1             | 9,237           | 4.8              |
| 27                         | Minnesota                 | 40,970     | 7.7              | 155,143         | 8.5              | 233,778    | 13.3             | 131,542         | 5.9              | 51,111     | 13.6             | 27,537     | 11.8             | 28,673          | 14.7             |
| 29                         | Missouri                  | 36,109     | 6.8              | 181,675         | 10.0             | 136,914    | 7.8              | 361,548         | 16.3             | 20,949     | 5.6              | 11,079     | 4.8              | 31,120          | 16.0             |
| 31                         | Nebraska                  | 7,274      | 1.4              | 58,619          | 3.2              | 11,008     | 0.6              | 73,487          | 3.3              | 13,105     | 3.5              | 4,638      | 2.0              | 30,731          | 15.8             |
| 40                         | Oklahoma                  | 36,987     | 7.0              | 158,972         | 8.7              | 78,430     | 4.5              | 148,852         | 6.7              | 18,009     | 4.8              | 9,776      | 4.2              | 24,256          | 12.5             |
| 48                         | Texas                     | 152,720    | 28.7             | 600,912         | 32.9             | 522,407    | 29.7             | 805,714         | 36.2             | 83,354     | 22.2             | 48,855     | 21.0             | 255             | 0.1              |
| 405                        | Fond du Lac Tribe         | 3          | 0.0              | 501             | 0.0              | 129        | 0.0              | 0               | 0.0              | 8          | 0.0              | 8          | 0.0              |                 | 0.0              |
| 407                        | Leech Lake Band of Ojibwe | 18         | 0.0              | 397             | 0.0              | 1,145      | 0.1              |                 | 0.0              | 121        | 0.0              | 88         | 0.0              | 4               | 0.0              |
|                            | Totals                    | 532,229    | 100              | 1,825,128       | 100              | 1,761,327  | 100              | 2,222,998       | 100              | 375,842    | 100              | 233,070    | 100              | 194,467         | 100              |

**Table 2d. Summary of Nonroad Source Emissions by State and Pollutant**

| State FIPS/<br>Tribal Code | State/Tribal Name | VOC        |                  | NO <sub>x</sub> |                  | CO         |                  | SO <sub>2</sub> |                  | PM10-PRI   |                  | PM25-PRI   |                  | NH <sub>3</sub> |                  |
|----------------------------|-------------------|------------|------------------|-----------------|------------------|------------|------------------|-----------------|------------------|------------|------------------|------------|------------------|-----------------|------------------|
|                            |                   | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total |
| 05                         | Arkansas          | 49,246     | 7.5              | 62,472          | 6.5              | 272,626    | 6.3              | 5,490           | 5.8              | 5,673      | 6.8              | 5,220      | 6.8              | 49              | 3.6              |
| 19                         | Iowa              | 58,021     | 8.8              | 92,893          | 9.6              | 363,341    | 8.4              | 9,070           | 9.5              | 9,746      | 11.8             | 8,939      | 11.6             | 80              | 5.9              |
| 20                         | Kansas            | 26,400     | 4.0              | 82,697          | 8.6              | 261,770    | 6.0              | 8,101           | 8.5              | 6,549      | 7.9              | 5,993      | 7.8              | 115             | 8.4              |
| 22                         | Louisiana         | 106,422    | 16.1             | 114,710         | 11.9             | 531,424    | 12.2             | 16,961          | 17.8             | 10,410     | 12.6             | 9,558      | 12.5             | 563             | 41.4             |
| 27                         | Minnesota         | 83,419     | 12.7             | 100,479         | 10.4             | 446,922    | 10.3             | 8,719           | 9.2              | 9,343      | 11.3             | 8,576      | 11.2             | 90              | 6.6              |
| 29                         | Missouri          | 126,923    | 19.3             | 99,306          | 10.3             | 754,272    | 17.4             | 9,351           | 9.8              | 13,064     | 15.8             | 11,985     | 15.6             | 74              | 5.4              |
| 31                         | Nebraska          | 24,882     | 3.8              | 119,568         | 12.4             | 175,694    | 4.1              | 11,011          | 11.6             | 7,491      | 9.0              | 6,785      | 8.8              | 59              | 4.3              |
| 40                         | Oklahoma          | 47,863     | 7.3              | 49,396          | 5.1              | 324,391    | 7.5              | 4,773           | 5.0              | 5,085      | 6.1              | 4,652      | 6.1              | 280             | 20.6             |
| 48                         | Texas             | 136,139    | 20.7             | 242,551         | 25.2             | 1,210,158  | 27.9             | 21,828          | 22.9             | 15,556     | 18.8             | 15,090     | 19.7             | 52              | 3.8              |
|                            | Totals            | 659,316    | 100              | 964,071         | 100              | 4,340,598  | 100              | 95,304          | 100              | 82,916     | 100              | 76,798     | 100              | 1,361           | 100              |

**Table 2e. Summary of Onroad Source Emissions by State and Pollutant**

| State FIPS/<br>Tribal Code | State/Tribal Name | VOC        |                  | NO <sub>x</sub> |                  | CO         |                  | SO <sub>2</sub> |                  | PM10-PRI   |                  | PM25-PRI   |                  | NH <sub>3</sub> |                  |
|----------------------------|-------------------|------------|------------------|-----------------|------------------|------------|------------------|-----------------|------------------|------------|------------------|------------|------------------|-----------------|------------------|
|                            |                   | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year | Percent of Total | Tons/ Year      | Percent of Total |
| 05                         | Arkansas          | 49,483     | 5.3              | 141,894         | 8.2              | 669,213    | 5.2              | 3,902           | 8.2              | 3,551      | 9.4              | 2,786      | 10.2             | 2,480           | 4.9              |
| 19                         | Iowa              | 81,535     | 8.8              | 109,454         | 6.3              | 1,096,877  | 8.6              | 2,916           | 6.1              | 1,975      | 5.2              | 1,403      | 5.2              | 2,797           | 5.6              |
| 20                         | Kansas            | 69,584     | 7.5              | 90,891          | 5.2              | 955,979    | 7.5              | 2,816           | 5.9              | 1,808      | 4.8              | 1,284      | 4.7              | 2,570           | 5.1              |
| 22                         | Louisiana         | 76,998     | 8.3              | 180,664         | 10.4             | 983,215    | 7.7              | 5,047           | 10.6             | 4,212      | 11.2             | 3,219      | 11.8             | 4,037           | 8.0              |
| 27                         | Minnesota         | 102,342    | 11.0             | 171,875         | 9.9              | 1,573,984  | 12.3             | 2,744           | 5.8              | 3,605      | 9.6              | 2,562      | 9.4              | 5,315           | 10.6             |
| 29                         | Missouri          | 90,574     | 9.7              | 172,355         | 9.9              | 1,447,795  | 11.3             | 4,873           | 10.2             | 3,789      | 10.1             | 2,704      | 9.9              | 5,469           | 10.9             |
| 31                         | Nebraska          | 43,113     | 4.6              | 61,850          | 3.6              | 603,091    | 4.7              | 1,822           | 3.8              | 1,277      | 3.4              | 930        | 3.4              | 1,614           | 3.2              |
| 40                         | Oklahoma          | 101,740    | 10.9             | 142,592         | 8.2              | 1,354,266  | 10.6             | 4,708           | 9.9              | 3,054      | 8.1              | 2,171      | 8.0              | 4,434           | 8.8              |
| 48                         | Texas             | 315,337    | 33.9             | 664,163         | 38.3             | 4,098,390  | 32.1             | 18,815          | 39.5             | 14,379     | 38.2             | 10,171     | 37.4             | 21,601          | 42.9             |
|                            | Totals            | 930,704    | 100              | 1,735,738       | 100              | 12,782,810 | 100              | 47,644          | 100              | 37,649     | 100              | 27,231     | 100              | 50,317          | 100              |

**Table 2f. Summary of Tribal Area Source Emissions**

| Tribal Code | Tribal Name                                      | VOC           | NO <sub>x</sub> | CO            | SO <sub>2</sub> | PM-PRI        | PM10-PRI      | PM25-PRI      | NH <sub>3</sub> |
|-------------|--|---------------|-----------------|---------------|-----------------|---------------|---------------|---------------|-----------------|
|             |  | Tons/<br>Year | Tons/<br>Year   | Tons/<br>Year | Tons/<br>Year   | Tons/<br>Year | Tons/<br>Year | Tons/<br>Year | Tons/<br>Year   |
| 405         | Fond du Lac Band of the Minnesota Chippewa Tribe | 0             | 0               | 571           | 0               | 1,883         | 12,246        | 1,883         | 0               |
| 407         | Leech Lake Band of Ojibwe                        | 22            | 8.2             | 105           | 1               | 20            | 0             | 0             | 0.95            |
|             | Totals   | 22            | 8               | 676           | 1               | 1,903         | 12,246        | 1,883         | 1               |

## II. REFINEMENT OF THE CRITERIA AIR POLLUTANT AND NH<sub>3</sub> INVENTORIES FOR THE CENRAP REGION

### A. Introduction

The following data sources were used to update CENRAP's 2002 Base A inventories:

- (5) S/L/T agency comments on the "Base A" inventories;
- (6) S/L/T agency comments on the draft 2002 NEI;
- (7) Revisions to CENRAP-sponsored inventories; and
- (8) Comments from CENRAP's EI and Modeling Workgroups.

Table 3 provides a summary of the S/L/T agency data received for updating CENRAP's Base A inventories. Prior to using the data to update the Base A inventories, Pechan performed QA review of the inventories to identify (1) remaining QA issues that needed to be resolved through consultation with the agency and/or the EI and Modeling Workgroups, and (2) missing data that needed to be added to the inventories to support air quality modeling studies. As a result of the QA review, and after consulting with KS and MO, it was agreed that the point source inventory data they provided would not be used in the Base B point source inventory (see section II.B for additional details).

**Table 3. Summary of S/L/T Agencies that Provided Data for Updating CENRAP's Inventories<sup>1</sup>**

| State/Local/Tribal Agency                        | Point            | Area           | Nonroad        |
|--|------------------|----------------|----------------|
| AR   | x <sup>2</sup>   | x <sup>3</sup> |                |
| Fond du Lac Band of the Minnesota Chippewa Tribe |                  |                |                |
| IA   | x <sup>4</sup>   |                |                |
| KS   | x <sup>4,5</sup> |                |                |
| LA   |                  |                |                |
| Leech Lake Band of Ojibwe Tribe                  | x <sup>6</sup>   | x <sup>6</sup> |                |
| MN   | x <sup>4</sup>   | x <sup>3</sup> |                |
| MO   | x <sup>4,5</sup> |                |                |
| NE-State   |                  |                |                |
| NE-Lincoln (Lancaster County)                    |                  |                |                |
| NE-Omaha (Douglas County)                        |                  |                |                |
| OK   |                  |                |                |
| TX   |                  | x <sup>4</sup> | x <sup>3</sup> |

<sup>1</sup> An "x" identifies the sector for which a S/L/T agency provided data to revise the Base A inventory.

<sup>2</sup> Agency provided inventory that completely replaced its Base A inventory data.

<sup>3</sup> Agency provided comments on CENRAP's Base A inventory.

<sup>4</sup> Agency provided comments on draft 2002 NEI that were used to update the Base A inventory.

<sup>5</sup> Agency provided comments but comments not used per agreement with the agency.

<sup>6</sup> Agency provided a new inventory not included in the Base A inventory.

After resolving the QA issues, the files were updated to revise or add data provided by the S/L/T agencies. In addition, the CENRAP's Base A NONROAD model inventory was revised to correct input data for the oxygen content of fuels and the SO<sub>2</sub> content of diesel fuel. Thus, the nonroad inventory for the NONROAD model categories was updated for all states that elected to use this inventory in the CENRAP inventory. Also, revisions were completed on all sectors to address comments from the EI and Modeling Workgroups.

The following sections B, C, and D provide the methods for updating CENRAP's 2002 Base A inventories for point, area, and nonroad sources, respectively. Each section discusses the QA review that was conducted on the S/L/T inventories to identify QA issues that were corrected to support air quality modeling. Then, each section discusses the augmentation procedures that were applied to fill in missing data. These procedures identify supplemental data that S/L/T agencies provided to add to or replace data in their inventories, the CENRAP-sponsored inventories that were added to the inventories as approved by the S/L/T agencies, and the 2002 NEI categories that S/L/T agencies requested to be added to their inventories. The augmentation procedures also explain how missing PM emissions were estimated and added to the inventories after incorporating inventory data supplied by S/L/T agencies, the CENRAP-sponsored inventory data, and data from the 2002 NEI.

Section E presents the data sources and methods for preparing the 2018 projection year inventory for EGUs. Section F documents the SMOKE and RPO data exchange protocol files prepared under this project.

## **B. Point Source Inventory Methods**

### **1. Data Sources**

For each S/L/T inventory that provided updates, Table 4 provides a summary of the pollutants included in each inventory, and compares the number of counties in the inventory to the number of counties in the 2002 preliminary NEI and in each S/L/T agency. The table also compares the number of facilities in the S/L/T inventory to the number of facilities in the 2002 preliminary NEI.

The inventories obtained from EPA are in Access 2000 databases in NIF 3.0. Each inventory was loaded into an Oracle database in NIF 3.0 to combine the inventories into a single data set. Then, after loading the inventories into Oracle in NIF 3.0, the following updates were performed on the consolidated data set, if necessary:

**Table 4. Summary of Pollutants, Number of Counties, and Number of Facilities in Point Source Inventories**

| State/Local/<br>Tribal Agency                          | CO | NH <sub>3</sub> | NO <sub>x</sub> | PM-PRI | PM10-PRI | PM25-PRI | PM10-FIL | PM25-FIL | PM-CON | SO <sub>2</sub> | VOC | Number of<br>Counties in<br>2002 S/L/T<br>Inventory<br>Comments | Number of<br>Counties in<br>2002<br>CENRAP<br>Inventory <sup>2</sup> | Number<br>of<br>Counties<br>in State | Number of<br>Facilities in<br>2002 S/L/T<br>Inventory<br>Comments | Number of<br>Facilities<br>in 2002 CENRAP<br>Inventory <sup>2</sup> |
|--|----|-----------------|-----------------|--------|----------|----------|----------|----------|--------|-----------------|-----|---|--|--------------------------------------|---|---|
| AR   | x  | x               | x               | x      | x        | x        |          |          |        | x               | x   | 57  | 70   | 75                                   | 231   | 1281  |
| IA <sup>1</sup>  |    |                 |                 |        |          |          |          |          |        | x               |     | 5   | 99   | 99                                   | 7   | 1871  |
| KS <sup>1</sup>  | x  | x               | x               |        |          |          | x        | x        |        | x               | x   | 4   | 105  | 105                                  | 4   | 5046  |
| MN <sup>1</sup>  | x  | x               | x               |        | x        | x        |          | x        |        | x               | x   | 72  | 87   | 87                                   | 542   | 6095  |
| Leech Lake<br>Band of the<br>Minnesota<br>Ojibwe Tribe | x  | x               | x               | x      | x        |          |          |          |        |                 | x   | - <sup>3</sup>  | - <sup>3</sup>   | - <sup>3</sup>                       | 2   | 0   |

<sup>1</sup> State submitted comment records ("A" and "D" submittal flags). Therefore, entries will refer only to the "A" (Add) or "RA" (Revise Add) records. Note, ultimately KS inventory comments were not used to update the Base A inventory.

<sup>2</sup> Refers to the counties in the 2002 CENRAP modeling inventory which could include CENRAP-sponsored inventories for NH<sub>3</sub>, fires, and confined animal feeding operations.

<sup>3</sup> NA = Not Applicable.



- Hazardous air pollutant (HAP) records were removed since the inventory will support regional haze, fine PM, and ozone modeling.
- Pollutant codes were corrected to make them NIF 3.0 compliant (e.g., update PMPRI pollutant code to PM-PRI). Additionally, other codes were identified for remediation on a case-by-case basis.
- The NIF 3.0 submittal flag field, when populated by an agency, provides the directions needed to determine how to revise the 2002 inventory. For this project, comment files obtained from EPA reflected comments on the draft NEI and not on CENRAP's 2002 inventory. Therefore, Pechan reviewed the submittal flag codes, compared the comment file to the CENRAP inventory, and consulted with the S/L/T agency to verify what records in the comment file were to be used to revise the CENRAP inventory. Pechan adjusted the submittal flags as necessary to document the records in the comment file that replaced records in CENRAP's 2002 inventory.
- Null values in the tribal code field were updated to '000' since this field is a part of the data key that defines records as unique in all eight NIF tables.
- The following NIF plus fields were added to the Transmittal (TR), Site (SI), Emission Unit (EU), Emission Release Point (ER), Emission Process (EP), Emission Period (PE), Emission (EM), and Control Equipment (CE) tables:
  - Data Source Codes:

| <u>Code</u> | <u>Description</u>  |
|-------------|---|
| S           | State agency-supplied data.   |
| L           | Local agency-supplied data.   |
| R           | Tribal agency-supplied data.  |
| P           | Regional Planning Organization.   |
| SC          | S/L/T agency Corrected.   |
| AUG-A       | PM Augmentation: ad-hoc change.   |
| AUG-C       | PM Augmentation: standard augmentation method.  |
| AUG-O       | PM Augmentation: set PMxx-FIL = PMxx-PRI where for SCCs starting with 10 (external fuel combustion) and 20 (internal fuel combustion). Note: emission factors and particle-size data for estimating condensible emissions for fuel combustion SCCs starting with 30 were not available; therefore, condensible emissions were not estimated for these processes if an agency provided filterable and not primary emissions for these processes. |
| AUG-Z       | PM Augmentation: automated fill-in of zero values where all PM for a particular process is zero.  |
| GENPARENT   | Data source where a parent record was system generated.   |

- Revision Date: This field indicates the month and year during which the last revision was made to a record. For the Base B inventory, for new or updated records, it is 0705.
- State Federal Information Processing Standard (FIPS): This field indicates the state FIPS code of the submittal.
- County FIPS: This field indicates the county FIPS code of the submittal.
- The following NIF plus fields were added to the EM table:
  - Emission Ton Value: This field indicates the values of the emissions in tons. This field was used to prepare summaries of emissions on a consistent emission unit basis.
  - Emission Type Period: This field indicates the period of the Emission Type – either ANNUAL or NONANNUAL. This field was used to prepare summaries of annual emissions.
  - CAP\_HAP: This field identifies records for CAP versus records for HAPs. For the CENRAP inventory, the flag is CAP for all records.
  - Year: This field indicates the year of the data; for this inventory, it is 2002.

## 2. QA Review

QA review on the inventories was conducted in accordance with the QA procedures specified in the QAPP for this project (CENRAP, 2005b).

The following data elements were reviewed to identify QA issues:

- Emission Release Point (ERP) or Stack Coordinates;
- ERP (Stack) Parameters;
- PM Emissions Consistency and Completeness;
- Control Devices and Efficiencies;
- Start and End Dates; and
- Annual and Daily Emissions Comparison.

As appropriate, individual S/L/T agencies were contacted with QA questions in order to receive direction on corrections.

### *a. County and Facility Coverage*

S/L/T agencies which submitted complete replacement inventories or replacement facility information (Arkansas, Leech Lake) were compared to their previous year's submittal as

appropriate to determine if there is a significant change in county coverage, facility coverage, or emissions.

*b. Pollutant Coverage*

S/L/T agencies which submitted complete replacement inventories (Arkansas, Leech Lake) were reviewed for pollutant coverage and other potential issues. Arkansas' Base A inventory included emission data from the CENRAP-sponsored inventories for confined animal feeding operations and planned burning. The CENRAP-sponsored emissions data were merged with Arkansas' new inventory.

Arkansas, Minnesota, and Leech Lake include replacements and/or revisions to their PM data. On processes where the PM data were replaced or revised with new data, the PM augmentation routine was applied. The QA review of the PM data is discussed further in the following section, and the augmentation procedures are discussed in section II.B.4.

*c. Particulate Matter (PM) Emissions Consistency and Completeness Review*

The following consistency checks were performed at the EM table data key level (for annual emissions) to compare PM emissions:

- If a process was associated with a PM emission record, but was missing one or more of the following (as appropriate for the Source Classification Code [SCC] [i.e., condensible PM (PM-CON) is associated with fuel combustion only]): PM10-FIL, PM10-PRI, PM25-FIL, PM25-PRI, or PM-CON, the record was flagged for review.
- The following equations were used to determine consistency:

$$\begin{aligned} \text{PM10-FIL} + \text{PM-CON} &= \text{PM10-PRI} \\ \text{PM25-FIL} + \text{PM-CON} &= \text{PM25-PRI} \\ \text{PM-FIL} + \text{PM-CON} &= \text{PM-PRI (as appropriate)} \end{aligned}$$

- The following comparisons were applied to determine consistency:

$$\begin{aligned} \text{PM10-PRI} &\geq \text{PM10-FIL} \\ \text{PM25-PRI} &\geq \text{PM25-FIL} \\ \text{PM10-PRI} &\geq \text{PM-CON} \\ \text{PM25-PRI} &\geq \text{PM-CON} \\ \text{PM10-FIL} &\geq \text{PM25-FIL} \\ \text{PM10-PRI} &\geq \text{PM25-PRI} \\ \text{PM-PRI} &\geq \text{PM10-PRI (as appropriate)} \\ \text{PM-PRI} &\geq \text{PM25-PRI (as appropriate)} \\ \text{PM-FIL} &\geq \text{PM10-FIL (as appropriate)} \\ \text{PM-FIL} &\geq \text{PM25-FIL (as appropriate)} \end{aligned}$$

If the data failed one of these checks it was diagnosed as an error. If a S/L/T agency did not provide corrections to these errors, the errors were corrected/filled in according to the augmentation procedure discussed in section II.B.4.

*d. Emission Release Point (ERP) Coordinate Review*

Location coordinates for new point sources were evaluated using geographic information system (GIS) mapping to determine if the coordinates were within 0.5-kilometers of the boundary of the county in which the source was located. ERP records with coordinates located more than 0.5, 1, 2, 3, 5, 7, and 10 or more kilometers from their county boundary, and coordinates that mapped outside of their state boundary were identified. Arkansas' new point source inventory contained what appeared to be new coordinates not included in its Base A inventory. However, Arkansas indicated that the ERP information had not changed significantly since the original submittal was submitted for ERP coordinate review. Coordinates for the Leech Lake submittal were manually reviewed and it was verified that the coordinates fell within the tribal area boundaries.

*e. ERP Parameter Review*

The EPA's QA guidance for diagnosing ERP issues for the point source NEI (EPA, 2004b) was applied to identify QA issues in the S/L/T point source inventories. The QA guidance involved diagnosing the correct assignment of the ERP type (i.e., stack or fugitive), parameters with zero values, parameters not within the range of values specified in the EPA's QA procedures, and consistency checks (i.e., comparing calculated values against expected values). In many cases errors were due to defaulted zeros, and submitting agencies were requested to provide the value. In other cases, out-of-range errors were caused by unit conversion issues (e.g., stack parameters were in ft, ft/sec, cu ft/sec or degrees Fahrenheit). The data were corrected or filled in according to the ERP parameter augmentation procedure discussed in section II.B.4.

*f. Control Device Type and Control Efficiency Data Review*

The CE codes in the "Primary Device Type Code" and "Secondary Device Type Code" fields were reviewed to identify invalid codes (i.e., codes that did not exist in the NIF 3.0 reference table) and missing codes (e.g., records with a null or uncontrolled code of 000 but with control efficiency data).

QA review of control efficiency data involved diagnosis of two types of errors. First, records were reviewed to identify control efficiency values that were reported as a decimal rather than as a percent value. Records with control efficiencies with decimal values were flagged as a potential error (although not necessarily an error, since the real control efficiency may be less than 1 percent).

The second check identified records where 100 percent control was reported in the CE table, but the emissions in the EM table were greater than zero and the rule effectiveness value in the EM table was null, zero, or 100 percent (implying 100 percent control of emissions). Because many agencies did not populate the rule effectiveness field or a default value of zero was assigned, records with null or zero rule effectiveness values were included where the CE was 100 percent

and emissions were greater than zero. All new data submitted for updating CENRAP's point source inventory passed these QA checks.

*g. Start and End Date Checks*

QA review was conducted to identify start date and end date values in the PE and EM tables to confirm consistency with the inventory year in the transmittal table, and to confirm that the end date reported is greater than the start date reported. This check did not identify any QA issues with the data used to update the Base A inventory.

*h. Annual and Daily Emissions Comparison*

The following QA checks were conducted to identify potential errors associated with the incorrect reporting of daily and/or annual emissions:

- Multiple records coded at the process level as emission type 30, but with different start and end dates. While not a true duplicate, this may indicate an error or an inclusion of both annual and seasonal values. Only one record can be identified as the "ANNUAL" record.
- Multiple records coded at the process level (or SCC, in the case of area) as a daily emission type (27, 29, etc.) but with different start and end dates. While not a true duplicate, this may indicate an error or just an inclusion of additional types of daily emissions.
- Multiple records coded at the process level (or SCC, in the case of area) with the same start and end date, but different emission types. While not a true duplicate, this may indicate an error or just an inclusion of additional types of daily emissions.

All new data submitted for updating CENRAP's point source inventory passed these QA checks.

### **3. Responses from S/L/T Agencies**

The S/L/T agencies provided responses to questions about their data. When necessary, QA issues were summarized in Excel spreadsheets and sent to the agencies and the EI and Modeling Workgroups for review. The agencies or the Workgroups then provided direction for correcting the issues either by telephone or by e-mail.

### **4. Gap Filling and Augmentation**

The following discusses the augmentation procedures that were used to fill in missing data that were not supplied by the S/L/T agencies.

a. *PM Augmentation*

Pechan implemented procedures to estimate missing pollutant data from data provided by the S/L/T agencies in order to develop a complete set of PM10-PRI and PM25-PRI emissions to support air quality modeling.

The PM augmentation process gap-filled missing PM pollutant complements. For example, if a S/L/T agency provided only PM10-PRI pollutants the PM augmentation process filled in the PM25-PRI pollutants. The steps in the PM augmentation process were as follows:

- Initial QA and remediation of S/L/T provided PM pollutants;
- Development of PM factor ratios based on factors from the Factor Information and REtrieval (FIRE) Data System (Version 6.2) and the PM Calculator (EPA, 2003; EPA, 2004c);
- Implementation of the ratios; and
- Presentation of PM augmentation results to S/L/T agencies for review and comment.

Note: An Access database accompanies this documentation - *Reference Tables for PM Augmentation*. This database contains the SCC Control Device Ratio table, the Emission Factors table and Emission Factors Crosstab table discussed in Step 2. The PM Calculator ratio table can be provided upon request – it contains all possible combinations for SCC and Control Device types that are available in the PM Calculator.

These steps are further detailed below.

1. *Initial QA and Remediation of PM Pollutants*

S/L/T agencies were initially presented with files that detailed potential inconsistencies and missing information in their PM pollutant inventory. Inconsistencies in PM pollutants include the following:

- PM-PRI less than PM10-PRI, PM25-PRI, PM10-FIL, PM25-FIL, or PM-CON
- PM-FIL less than PM10-FIL, PM25-FIL
- PM10-PRI less than PM25-PRI, PM10-FIL, PM25-FIL or PM-CON
- PM10-FIL less than PM25-FIL
- PM25-PRI less than PM25-FIL or PM-CON
- The sum of PM10-FIL and PM-CON not equal to PM10-PRI
- The sum of PM25-FIL and PM-CON not equal to PM25-PRI

Potential missing information was summarized in a table which detailed the variety of cases provided by the S/L/T agency. For example, a S/L/T agency might have provided PM10-FIL and PM25-FIL for some processes, but for other processes only PM10-FIL was provided.

S/L/T agencies were asked to review this information and provide corrections where possible. In general, corrections (or general directions) were provided in the case of the potential inconsistency issues. An example of a general direction provided by a S/L/T agency was to

remove PM25-FIL where greater than PM10-FIL because the PM10-FIL was (in their particular case) known to be more reliable. In other cases, the agency-provided specific process level pollutant corrections. In general, if specific direction was not provided by the agency, priority was given to the PM<sub>10</sub> number.

## 2. *Development of PM Factor Ratio*

The primary deliverable of this step of the process was the development of a table keyed by SCC, primary control device, and secondary control device. This table is called the SCC Control Device Ratios table. The table structure is shown in Table 5 which follows the discussion below.

This table was filled according to the following steps:

- Ratios (both condensible and noncondensable) were added from FIRE for SCCs starting with 10\* (external fuel combustion) and 20\* (internal fuel combustion) where there was a direct match between the provided SCC, and primary and secondary control devices.
- Ratios (non-condensable) were added from the PM Calculator for SCCs starting with 10\* and 20\* where there was not a direct match between the provided SCC, and primary and secondary control devices. Condensible ratios were added from the PM Calculator based on the uncontrolled SCC for these SCCs. In some cases, it was necessary to map the SCC and control devices to the PM calculator to find a match for the noncondensable ratios. In some cases, it was necessary to map the SCC to FIRE to find a match for condensible ratios.
- For natural gas, process gas and liquefied petroleum gas SCCs starting with 10\* and 20\*, it was assumed (based on FIRE emission factors trend) that the PM-PRI/PM10-PRI/PM25-PRI ratio was equal to 1. It was also assumed that the PM-FIL/PM10-FIL /PM25- FIL was equal to 1. Condensible ratios were calculated from uncontrolled FIRE emission factors based for these SCCs. In some cases it was necessary to map the SCC to FIRE to find a match for condensible ratios.
- Ratios for SCCs not like 10\* and 20\* were obtained from the PM Calculator. It was assumed that the condensible component was zero.

Accompanying this document is a database containing the SCC Control Device Ratios table. Additionally, the Emission Factors and Emission Factors Crosstab table (which are derived from FIRE) are provided. The Emission Factors Crosstab table contains the ratios developed from the Emission Factors table. The Emission Factors table contains detailed information on the emission factors used to develop the ratios.

Note: Ratios from the PM calculator were developed using a standard input of 100 TONS of uncontrolled PM-FIL emissions.

**Table 5. Description of the Field Names and Descriptions for the SCC Ratio Table**

| <b>Field Name</b> | <b>Field Description</b>  |
|-------------------|---|
| PM Calculator     | A "Yes" in this field indicates that at least some of the information was retrieved from the PM Calculator  |
| FIRE              | A "Yes" in this field indicates that at least some of the information was retrieved from the Emission Factors table. A "Condensable Ratios" in this field indicates that the condensable ratios factors were retrieved from this table. |
| Other             | A field to indicate other sources as necessary.   |
| SCC               | Source category code from the S/L/T agency-provided data.   |
| SCC_DESC          | Description of source category code from the S/L/T agency-provided data.  |
| maptoSCC          | This field equals SCC unless the SCC provided was not found in the appropriate source table. In that case, the SCC was mapped using the closest available appropriate mapping choice.   |
| maptoSCC_DESC     | Description of the maptoSCC.  |
| mapSCCNote        | Any notes related to the mapping of the SCC. A "Yes" in this field indicates that the SCC was mapped.   |
| PD                | Primary device type from the S/L/T agency provided data.  |
| PD_DESC           | Description of the primary device (PD).   |
| maptoPD           | This field equals PD unless the PD provided was not found in the appropriate source table. In that case, the PD was mapped using the closest available appropriate mapping choice.  |
| maptoPD_DESC      | Description of the maptoPD.   |
| mapPDNote         | Any notes related to the mapping of the PD. A "Yes" in this field indicates that the PD was mapped.   |
| SD                | Secondary device type from the S/L/T agency provided data.  |
| SD_DESC           | Description of the secondary device (SD).   |
| maptoSD           | This field equals SD unless the SD provided was not found in the appropriate source table. In that case, the SD was mapped using the closest available appropriate mapping choice.  |
| maptoSD_DESC      | Description of the maptoSD.   |
| mapSDNote         | Any notes related to the mapping of the SD. A "Yes" in this field indicates that the SD was mapped.   |
| PM-FIL/PM10-FIL   | This field and the following are ratios calculated from emission factors found either in FIRE or the PM calculator.   |
| PM-FIL/PM25-FIL   | This field and the following are ratios calculated from emission factors found either in FIRE or the PM calculator.   |
| PM-FIL/PM-PRI     | This field and the following are ratios calculated from emission factors found either in FIRE or the PM calculator.   |
| PM-PRI/PM10-PRI   | This field and the following are ratios calculated from emission factors found either in FIRE or the PM calculator.   |
| PM-PRI/PM25-PRI   | This field and the following are ratios calculated from emission factors found either in FIRE or the PM calculator.   |
| PM10-FIL/PM25-FIL | This field and the following are ratios calculated from emission factors found either in FIRE or the PM calculator.   |
| PM10-PRI/PM25-PRI | This field and the following are ratios calculated from emission factors found either in FIRE or the PM calculator.   |
| PM-CON/PM10-FIL   | Condensable ratios were calculate from FIRE if available for 10* and 20* SCCs. If condensable ratios were not found in FIRE for 10* and 20* these ratios were set to zero.  |
| PM-CON/PM10-PRI   | Condensable ratios were calculate from FIRE if available for 10* and 20* SCCs. If condensable ratios were not found in FIRE for 10* and 20* these ratios were set to zero.  |
| PM-CON/PM25-FIL   | Condensable ratios were calculate from FIRE if available for 10* and 20* SCCs. If condensable ratios were not found in FIRE for 10* and 20* these ratios were set to zero.  |
| PM-CON/PM25-PRI   | Condensable ratios were calculate from FIRE if available for 10* and 20* SCCs. If condensable ratios were not found in FIRE for 10* and 20* these ratios were set to zero.  |
| PM-CON/PM-FIL     | Condensable ratios were calculate from FIRE if available for 10* and 20* SCCs. If condensable ratios were not found in FIRE for 10* and 20* these ratios were set to zero.  |
| PM-CON/PM-PRI     | Condensable ratios were calculate from FIRE if available for 10* and 20* SCCs. If condensable ratios were not found in FIRE for 10* and 20* these ratios were set to zero.  |
| RPO Specific Note | Indicates SCC and control device combinations are in the RPO inventory.   |
| Additional Notes  | Any notes regarding assumptions about ratios.   |



### 3. *Implementation of the QA Ratios*

In order to calculate the additional PM pollutants based on the SCC Control Device ratio table developed in the above step, a crosstab table was created from the EM table based on the following fields:

- State FIPS
- County FIPS
- Tribal Code
- Emission Unit identification (ID)
- Process ID
- Start Date
- End Date
- Emission Type
- SCC
- Primary Device Type
- Secondary Device Type

The primary and secondary device type fields were added based on information from the CE table. If control equipment information was not available these fields were defaulted to 000 (“UNCONTROLLED”). In the few cases where there was a conflict between the control devices reported for the same process for PM pollutants (for example, a PM10-PRI is listed as controlled, but PM-PRI did not have control information), the control device type was selected based on the controlled pollutant.

In addition to the fields listed above, the crosstab included the PM emission amounts for the particular process and a field that indicated whether those emissions existed in the inventory. These fields are as follows:

- PM\_PRI
- PM\_FIL
- PM10\_PRI
- PM10\_FIL
- PM25\_PRI
- PM25\_FIL
- PM\_CON
- PM\_PRI\_EXISTS
- PM\_FIL\_EXISTS
- PM10\_PRI\_EXISTS
- PM10\_FIL\_EXISTS
- PM25\_PRI\_EXISTS
- PM25\_FIL\_EXISTS
- PM\_CON\_EXISTS

The emission values are in the PM\_PRI, PM\_FIL, PM10\_PRI, PM10\_FIL, PM25\_PRI, PM25\_FIL, PM\_CON fields. The \_EXISTS field indicates whether the pollutant was provided by the S/L/T agency. A zero indicates that the pollutant was not provided; a number greater than zero (usually one) indicates that it was provided by the S/L/T agency.

Prior to the development of this crosstab, the EM table was filled in as much as possible using basic assumptions. For example, if the S/L/T agency provided emissions that were equal to zero for PMs for a particular process, it was assumed that all PMs for that process were zero and they were filled in accordingly. Since the assumption was that for non 10\* and 20\* SCCs, the condensible value was zero – that would lead to  $PM_{10-FIL} = PM_{10-PRI}$  and  $PM_{25-FIL} = PM_{25-PRI}$  and  $PM-FIL = PM-PRI$ . Given that assumption, values for these pollutants were also filled in. After this data insertion, a subset of the crosstab was created. This subset only contained processes that required additional augmentation. The SCC control device type ratio table described in step 2 was based on only those SCC and control device types that required augmentation.

The next step was to fill in the missing information in this crosstab using the information found in the SCC Control Device Ratio table.

In calculating PM complement pollutants, priority was given to calculating –PRI and –CON pollutants. FIL pollutants were only calculated if necessary to calculate other pollutants or if it was a by-product of this calculation.

In augmenting the PM pollutants the non 10\* and 20\* SCCs were augmented first, with order given to augmenting based on  $PM_{10}$  where available,  $PM_{25}$  where available, and then PM .

Augmenting the PM pollutants for the 10\* and 20\* SCCs is more complicated, but the basic approach was to augment based on  $PM_{10}$  (FIL or PRI) where available,  $PM_{2.5}$  (FIL or PRI) where available, and then PM (FIL or PRI) if  $PM_{10}$  or  $PM_{2.5}$  variations were not available. Where both  $PM_{10}$  (FIL or PRI) and  $PM_{2.5}$  (FIL or PRI) variations were both available, the calculation for PM-CON was generally driven from the  $PM_{10}$  number and the complements as necessary were back calculated. Where a –PRI emission factor ratio was required and was not available the –FIL emission factor ratio was used.

After calculations, the data was QA checked to ensure that the calculations resulted in consistent values for the PM complement. On a few occasions, the mix of ratio value and the pollutants and values provided by the S/L/T agency resulted in negative values when –FIL was back-calculated. In this case the negative –FIL value was set to zero and the –PRI value was readjusted.

The resultant PM table has the format described in Table 6.

**Note: There are some high condensible ratios that were calculated for some SCC device type combinations. In most cases these high condensible ratios were the result of the back calculation of PM-CON from  $PM_{10-PRI}$  or  $PM_{25-PRI}$  records. Since the state had**

already provided the PMxx-PRI records, these PM-CON values were not added to the inventory.

**Table 6. Description of the Field Names and Descriptions for the Resulting PM Augmentation Table**

| <b>Field Name</b>          | <b>Field Description</b>   |
|----------------------------|--|
| Augment                    | A "Yes" in this field indicates that the process PM was augmented.                           |
| Condensable Note           | If condensable information was added this field will note that.                              |
| STATE_FIPS                 | State FIPS   |
| COUNTY_FIPS                | County FIPS  |
| STATE_FACILITY_IDENTIFIER  | Site ID  |
| EMISSION_UNIT_ID           | Emission Unit  |
| PROCESS_ID                 | Process  |
| START_DATE                 | Start Date   |
| END_DATE                   | End Date   |
| EMISSION_TYPE              | Emission type  |
| SCC                        | Source Category Code   |
| SCC_DESC                   | SCC description  |
| PRIMARY_DEVICE_TYPE        | Primary Device Type  |
| PRIMARY_DEVICE_TYPE_DESC   | PDT description  |
| SECONDARY_DEVICE_TYPE      | Secondary Device Type  |
| SECONDARY_DEVICE_TYPE_DESC | SDT description  |
| EMISSION_TYPE_PERIOD       | Emission Type Period   |
| EMISSION_RELEASE_POINT_ID  | Emission Release Point ID  |
| FACILITY_NAME              | Facility Name  |
| ORIS_FACILITY_CODE         | ORIS facility Code   |
| SIC_PRIMARY                | SIC  |
| ACTUAL_THROUGHPUT          | Actual Throughput  |
| THROUGHPUT_UNIT_NUMERATOR  | Throughput Unit Numerator  |
| PM_PRI                     | Emission ton value for PM-PRI  |
| PM_FIL                     | Emission ton value for PM-FIL  |
| PM10_PRI                   | Emission ton value for PM10-PRI  |
| PM25_PRI                   | Emission ton value for PM25-PRI  |
| PM10_FIL                   | Emission ton value for PM10-FIL  |
| PM25_FIL                   | Emission ton value for PM25-FIL  |
| PM_CON                     | Emission ton value for PM-CON  |
| PM_PRI_EXISTS              | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| PM_FIL_EXISTS              | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| PM10_PRI_EXISTS            | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| PM25_PRI_EXISTS            | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| PM10_FIL_EXISTS            | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| PM25_FIL_EXISTS            | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| PM_CON_EXISTS              | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| RECORD_COUNT               | 0 if the S/L/T agency did not provide, > 0 if S/L/T agency did provide                       |
| System Update Note         | This field contains system codes related to the update queries used to calculate the record. |

The data source code field is used to identify records that are added to the inventory to complete the set of PM10-PRI and PM25-PRI emissions needed to support modeling.

*b. ERP Coordinates*

If a S/L/T agency did not provide corrections for ERP coordinates that map more than 5 km outside of the county boundary, or provide coordinates for ERP records that did not have any coordinates in the S/L/T inventory, the following procedures were applied to replace the coordinates:

- Coordinates for other ERPs at the same facility, if available, that map within the county;
- Coordinates for the centroid of the zip code for a facility if a valid zip code is provided or can be obtained from the agency if it is not valid; or
- County centroid coordinates.

The zip code was taken from the SI NIF 3.0 table. The zip code was compared to a reference table of valid zip codes to verify that it is an active zip code and exists in the state and county reported in the inventory. For example, a zip code may be invalid if it is for the mailing address or address of a facility's parent company rather than the address of the facility's location. If a valid zip code for a facility was not identified, Pechan used the centroid for the facility's county as a last resort.

*c. ERP Parameters*

If valid ERP parameters were not provided by the S/L/T agency, Pechan applied the ERP augmentation procedures for the 2002 point source NEI (EPA, 2004b). It has been determined that the augmentation procedures in this document regarding SCC-specific ERP types and temperatures are difficult to resolve. When this situation occurs, preference was given to the state-supplied ERP type and SCC. For example, the procedures do not account for cases where an emission unit has two processes with one defined as a stack source and the other as a fugitive source. Therefore, the S/L/T-supplied ERP type was used when this situation occurred.

*d. Control Device Type and Control Efficiency Data*

If a S/L/T agency did provide valid control device type codes to replace invalid codes identified in the inventory, Pechan changed the valid NIF 3.0 code of 099 for miscellaneous control devices. In the case of modeled data where no control device information was provided, the records were left unchanged.

Pechan expected that control equipment data issues would be resolved through consultation with the S/LT Agencies. Default augmentation procedures were developed and applied to resolve control efficiency issues. In the event that control efficiency issues were not resolved, Pechan documented the QA issues in the final report.

## 5. Revisions to Address Comments

The following items were revised per S/L/T agency instructions:

### *a. Arkansas*

Arkansas sent a complete replacement inventory. Arkansas confirmed that they revised the SCCs and emissions in this new inventory. Therefore, the previous Base A inventory was used as a guide for correcting ER coordinates and stacks and other QA issues.

County 777 information was removed from the entire inventory (4 facilities with 34 emission records).

### *CE*

It was noted by Arkansas that they had not sent any CE records. They confirmed this as intentional.

### *EM*

Removed PM-PRI and PM-FIL with emission numeric values of 0 (2,437 records) and 8 PM10-FIL/PRI records where the remaining PMxx-FIL/PRI information was non-zero.

Updated emission calculation method code from 4 to 04 (1,706 records).

Material codes of “0” were nulled out (44 records).

Material IO codes of “U” were nulled out (44 records).

Nulled out the invalid factor unit denominator value of “UNK”, or nulled out the factor unit denominator value if the factor unit numerator was null (44 records).

Where PM25-PRI values were greater than PM10-PRI values, the PM25-PRI values were set equal to PM10-PRI values per instruction from the state.

Note: The NH<sub>3</sub> emissions in Arkansas’ new inventory decreased considerably from the emissions in the Base A inventory. A comparison of the emissions was provided to Arkansas for review and confirmation that the revised emissions are correct.

### *PE*

Material codes of “0” were nulled out (6 records).

Material IO codes of “U” were nulled out (6 records).

Nulled out throughput unit numerator where noted as “UNK” (6 records).

### *EP*

The Arkansas inventory contained six inactive SCCs (i.e., SCCs in EPA's February 2004 master list that are identified as no longer used by EPA) that were changed to active SCCs as follows:

- 28888802 was replaced by 28888801
- 30800197 was replaced by 30800199
- 30703096 was replaced by 3070399
- 30703098 was replaced by 3070399
- 30699998 was replaced by 30699999
- 30700798 was replaced by 30700799

Updated one EP record to reset its operating percentages for the 4 seasons from all 24s to all 25s in order to make the sum of activity consistent.

### *ER*

Where EP was parentless, ER records were added to the inventory. The ERP type was set to "01" if total stack emissions for all pollutants combined was less than or equal to 100 tons per year, or to "02" if total stack emissions for all pollutants combined was more than 100 tons per year.

21 invalid ER types were updated based on the Base A inventory.

Updated 107 of Arkansas coordinates based on Base A inventory.

Stack augmentation and coordinate augmentation was implemented on any remaining missing or invalid values.

### *EU*

One emission unit record was generated in order to maintain referential integrity.

### *SI*

Two site records were generated in order to maintain referential integrity.

### *TR*

The affiliation type "report\_certifier" was changed to "Report Certifier".

## *b. Iowa*

Iowa provided additions and revisions to their SO<sub>2</sub> emissions. These revisions were applied to their submittal.

*EM*

Emission revisions were made to records where the data keys in the comments matched those in the inventory. Emission records were added to the Base B inventory where there was no data key match. In order to maintain referential integrity, records in the comment file were added to the ER, EU, EP, and PE tables. In addition, a correction was made to the start and end dates to ensure that they all started with 2002, in some cases, 2003 was used.

*c. Kansas*

Kansas provided comments to the EPA; however, after an initial incorporation of emission comments into the inventory – it was determined through state review that the comments did not apply to the CENRAP inventory. These emissions were restored to their original values. Essentially, the Kansas inventory remained unchanged.

*d. Minnesota*

Minnesota submitted new information for municipal airport emissions as well as revisions to their PM data.

*ER*

When inserting the new municipal airport emissions, 236 fugitive records were defaulted to the fugitive defaults. Eight records noted as stacks were defaulted to stack defaults. Coordinates were compared manually either to the previous Minnesota submittal which had been QA checked or manually compared to known county boundaries.

*EM*

When incorporating the new municipal airport information, it was determined that there were 13 duplicate records and one inconsistent ER-EU combination for NH<sub>3</sub>. The new information submitted was selected over the previous information.

Minnesota included updates to their PM information. Where the PM values were new, they were added to the inventory (after removing previously augmented data). Where the PM values were revisions, the records were revised (after removing previously augmented data). When the PM QA check indicated that there were significant discrepancies between the relative values of PM<sub>10</sub>-PRI and PM<sub>25</sub>-PRI, it was determined through consultation with the state there was a problem in the export program that the state used to create the NIF 3.0 text file. Essentially, it was truncating the exponential part of the emission numeric value in the file. Minnesota provided a corrected file. This corrected file was used to update the PM<sub>25</sub>-FIL/PRI values. After these values were incorporated, there were still several comparative problems. Upon review, it was determined that a number of these comparative problems were due to rounding –

essentially comparing numbers in this fashion -  $PM_{10}\text{-PRI} = 0.01999$  and  $PM_{25}\text{-PRI} = 0.02$ . The program would flag an error, even though it was a result of rounding. In these cases, the values were rounded appropriately. For 55 records, the  $PM_{25}\text{-PRI}$  values were set to the calculated value in order to resolve this type of issue. After resolving these values, the PM augmentation procedure was run.

### *Wildfires and Agricultural Field Burning*

For the Base A modeling effort, the Midwest RPO's point source inventory for wildfires (SCC 2810001000) and agricultural field burning (SCC 2801500000) was to be used for Minnesota. The point source inventory was included in the NIF 3.0 file for Minnesota to support development of emissions summaries (the Midwest RPO provided the inventory in point source SMOKE input format). However, it was learned that the Midwest RPO point source inventory was not being used for modeling so the 2002 point source wildfire and agricultural field burning emissions data were removed from the Base B point source inventory and restored to the Base B area source inventory.

#### *e. Leech Lake*

Leech Lake provided a new inventory that was not included in the Base A inventory.

#### *ER*

Leech Lake did not provide stack information for a fugitive ERP. This was defaulted to the stated default fugitive ERP values.

Leech Lake did not provide exit velocity and exit flow information for two ERPs. These were defaulted according to the methods document.

#### *EM*

Leech Lake did not provide  $PM_{25}\text{-PRI}$  emissions. For the point source SCCs,  $PM_{25}\text{-PRI}$  emissions were estimated based on the PM augmentation methods. For the single area source SCC for prescribed burning, the  $PM_{25}\text{-PRI}$  emissions were estimated by dividing the  $PM_{10}\text{-PRI}$  emissions by a ratio of 1.14. This ratio is the lower of two values (1.18 and 1.14) most commonly used by the Midwest RPO during the development of the Minnesota prescribed burning inventory.

An examination of duplicates between tribal information and state information yielded one potential site duplicate – the Cloquet County municipal airport is listed in both the Minnesota (27017-000-27017XCOQ) and Leech Lake (00000-407- 05) inventories. The airport emissions in the two inventories are significantly different (29 tons of CO for Minnesota and .04 tons of CO for the tribe – the largest emission set) and there was insufficient information to determine if the emissions were duplicated when combined into the Base B inventory. The prescribed burning emissions for Leech Lake were also compared to the Minnesota prescribed burning inventory, and it was determined that there were no common ERP coordinates or other



information to indicate duplication of data. Thus, the airport emissions and prescribed burning emissions in Leech Lake's inventory were included in the Base B point source inventory.

*f. Missouri*

Missouri provided a complete replacement inventory; however, upon further discussion and agreement with Missouri, the replacement inventory was not used to update the Base A inventory.

*g. All CENRAP S/L/T agencies - Office of Regulatory Information Systems (ORIS) and ORIS Boiler ID Updates*

The ORIS identifiers in the SI and EU table were updated based on the crosswalk entitled CENRAPxwalk051005.mdb with modifications made for some emission unit identifier changes made by Arkansas. The revised crosswalk including the Arkansas changes was delivered to CENRAP on August 11, 2005.

*h. Stack Parameter updates per CENRAP instructions*

In addition to individual state submittals of data, stack parameter corrections were supplied to Pechan through CENRAP. These stack parameter comments affected 20 ERP records (4 in Iowa, 6 in Kansas, 5 in Louisiana, and 5 in Oklahoma) in one set of comments, and 15 records for Arkansas in another set of comments. There were some initial QA issues with the flow rate calculation; however, these issues were resolved by CENRAP and the revised comments were used to update the Base A inventory.

## **6. QA Review of Final Inventory**

Final QA checks were run on the revised point source inventory data set to ensure that all corrections provided by the S/L/T agencies were incorporated into the Base B inventory and that there were no remaining QA issues that could be addressed during the duration of the project. After exporting the inventory in Oracle to an Access database in NIF 3.0, the EPA QA program was run on the Access database and the QA output was reviewed to verify that all QA issues that could be addressed were resolved (EPA, 2004a)

This file accompanies this documentation with the specific details included. The following summarizes the remaining QA issues that could not be addressed during the duration of this project (listed by table):

### CE

Primary device type codes are null for the confined animal feeding operations and planned burning (forest and rangeland). The data originates from the CENRAP-sponsored inventories for these categories. Missouri also has null primary device types for the majority of the CE records it provided for NH<sub>3</sub> emissions.

### EM

The EPA QA program indicated that some emissions were outside the expected range. While this is a guideline and not a specific error, this listing could be reviewed for high values.

#### PE

There are a few (32) records with the units M2 and MASS that were not yet in the EPA QA program units reference table.

There are a few (8) remaining records with operating times outside the EPA QA program ranges.

#### EP

There are a few (9) remaining records with operating parameters and seasonal sums outside the expected range.

The SCC 30202000 has not yet been added to the EPA QA program SCC reference table.

#### ER

A significant number of records are missing the supplementary coordinate reference information (Horizontal data measure, horizontal data accuracy, horizontal collection method code).

Several records indicate coordinates outside of county boundaries – the reasons why this may occur were explained in the coordinate augmentation section earlier in this document.

Several records also indicate stack parameters outside of ranges expected by the EPA QA program. This is due either to the S/L/T agency specifically requesting not to change the values or to default values in the EPA table which fall outside of the EPA QA program ranges.

#### EU

Standard industrial classification (SIC) code 3041 is not in the SIC code table.

#### SI

The inventories (particularly the NH<sub>3</sub> inventory for confined animal feeding operations) did not provide zip code information with the site data. This accounts for a tremendous number of the invalid zip code errors found when running the EPA QA program. There are other records with zip code errors in addition to these; however, these inventories are the source of the majority of these errors.

NAICs codes are missing or invalid on some records (470), primarily in Nebraska and Oklahoma which did not provide comments during this time. The location address is missing for some records in Minnesota and Nebraska.

## TR

Some records are missing the transaction creation date information.

### **C. Area Source Inventory Methods**

#### **1. Data Sources**

The states of AR, TX, and MN provided comments for updating the Base A inventory. AR and MN provided comments on the Base A inventory, and TX provided comments on the draft 2002 nonpoint NEI that were applied to update the Base A inventory. The Leech Lake Band of Ojibwe Tribe provided a new area source inventory. In addition, the EI and Modeling Workgroups provided several comments resulting in revisions to the area source inventory. Documentation of the revisions made to the Base A inventory are provided in section II.C.5.

The data files that the states provided for updating the Base A inventory were loaded into Oracle in NIF 3.0 into one data set. Then, the following updates were performed on the consolidated data set, if necessary:

- HAP records were removed since the inventory will support regional haze, fine PM, and ozone modeling.
- Pollutant codes were corrected to make them NIF 3.0 compliant (e.g., update PMPRI pollutant code to PM-PRI). Additionally, other codes were identified for remediation on a case-by-case basis.
- The NIF 3.0 submittal flag field, when populated by an agency, provides the directions needed to determine how to revise the 2002 inventory. TX's comment file reflected comments on the draft NEI and not on CENRAP's 2002 inventory. Therefore, Pechan reviewed the submittal flag codes, compared the comment file to the CENRAP inventory, and consulted with TX to verify what records in the comment file were to be used to revise the CENRAP inventory. Pechan adjusted the submittal flags as necessary to document the records in the comment file that replaced records in CENRAP's 2002 inventory.
- Null values in the tribal code field were updated to '000' since this field is a part of the data key that defines records as unique in all five NIF tables.

The following NIF plus fields were added to the EP, PE, EM, and CE tables:

- Data Source Codes:

For the area and nonroad inventory data, the data source codes were based on the following 9-character format:

[Data Origin]-[Year]-[Grown/Not Grown/Carried Forward]-[PM Augmentation Code]

| <u>Code</u>                     | <u>Field Length</u>          |
|---------------------------------|------------------------------|
| Data Origin                     | 1                            |
| Year                            | 3 (including leading hyphen) |
| Grown/Not Grown/Carried Forward | 2 (including leading hyphen) |
| PM Augmentation                 | 3 (including leading hyphen) |

### Data Origin Codes

| <u>Code</u> | <u>Description</u>  |
|-------------|---|
| S           | State agency-supplied data                                    |
| L           | Local agency-supplied data                                    |
| R           | Tribal agency-supplied data                                   |
| P           | Regional Planning Organization-generated data                 |
| E           | EPA/Emission Factor and Inventory Group (EFIG)-generated data |

### Year Codes

Year for which data were supplied (e.g., Year = -02 for 2002), or from which prior year data were taken (e.g., Year = -99 for 1999; -01=2001).

### Grown/Carried Forward/Not Grown Codes

| <u>Code</u> | <u>Description</u>  |
|-------------|---|
| -G          | Used when emissions in a pre-2002 inventory were grown to represent 2002 emissions.   |
| -F          | Used when emissions in a pre-2002 inventory were carried forward and included in the 2002 inventory without adjustment for growth.  |
| -X          | Used when the emissions were not grown or were not carried forward. For example, X was used when emissions were calculated for the 2002 inventory using 2002 activity, or when data were replaced with 2002 S/L/T data. |

### PM Augmentation Codes

|     |  |
|-----|--|
| -PA | PM Augmented Emissions: Record for PM <sub>10</sub> /PM <sub>2.5</sub> emissions that were updated or added using ad-hoc updates.  |
| -PC | PM Augmented Emissions: Record added for PM <sub>10</sub> /PM <sub>2.5</sub> emissions estimated using the PM Calculator.  |
| -PR | PM Augmented Emissions: Record added for PM <sub>10</sub> /PM <sub>2.5</sub> emissions estimated using ratios of PM <sub>10</sub> -to-PM or PM <sub>2.5</sub> -to-PM <sub>10</sub> . If PM <sub>10</sub> and PM <sub>2.5</sub> emissions were equal and one of the pollutants was assigned this code, the ratio was assumed to be 1. |
| -VR | Missing pollutant estimated by multiplying the ratio of the missing pollutant emission factor to the VOC emission factor by the VOC emissions supplied by the S/L/T agency. This method was applied to estimate missing pollutant emissions in the 2002 NEI only. Records with this data source code in                              |

CENRAP's Base B inventory indicate that the data were copied from the NEI as directed by CENRAP agency comments.

-NR Missing pollutant estimated by multiplying the ratio of the missing pollutant emission factor to the NO<sub>x</sub> emission factor by the NO<sub>x</sub> emissions supplied by the S/L/T agency. This method was applied to estimate missing pollutant emissions in the 2002 NEI only. Records with this data source code in CENRAP's Base B inventory indicate that the data were copied from the NEI as directed by CENRAP agency comments.

## 2 QA Review

QA review was conducted on the S/L/T area source inventories in accordance with the QA procedures specified in the QAPP for this project (CENRAP, 2005b). The following discusses the QA checks that were completed during preparation of the Base B inventory.

### *a. County and SCC Coverage*

The county coverage in the state inventories appeared to be reasonable for all states. The SCC coverage was difficult to evaluate simply by showing a count of the number of SCCs by state. The EI and Modeling Workgroups reviewed summaries comparing the Base B to the Base A inventory and provided comments that are explained under section II.C.5.

### *b. Pollutant Coverage*

The pollutant coverage in the S/L/T inventories was complete for all pollutants except for PM<sub>10</sub> and PM<sub>2.5</sub>. Diagnosis and resolution of PM<sub>10</sub> and PM<sub>2.5</sub> pollutant emissions is discussed later in section II.C.5.

### *d. Additional QA for the CENRAP Area Source Inventory*

The following explains additional QA that was performed for the CENRAP inventory. The following data elements were reviewed to identify QA issues:

- Range Errors;
- PM Emissions Consistency and Completeness;
- Control Device Codes and Control Efficiency Values;
- Start and End Dates;
- Annual and Daily Emissions Comparison; and
- Comparison of Base B to the Base A inventory.

As appropriate, individual S/L/T agencies were contacted with QA questions in order to receive direction on corrections.

## Range Errors

The EPA's QA program was run on MN's and TX's comment files. The range errors identified by the QA program were deemed acceptable. Note that according to EPA, the ranges to which values in inventories are compared represent "normal" ranges that are based on percentiles from previous inventories. The range values are conservative in that EPA wants to identify suspicious values even though the values may be real (Thompson, 2002).

## PM Emissions Consistency and Completeness Review

The following consistency checks were performed at the EM table data key level (for annual emissions) to compare PM emissions:

- If an SCC was associated with a PM emission record, but was missing one or more of the following (as appropriate for the SCC [i.e., PM-CON is associated with fuel combustion only]): PM10-FIL, PM10-PRI, PM25-FIL, PM25-PRI, or PM-CON, the record was flagged for review.
- The following equations were used to determine consistency:

$$\begin{aligned}\text{PM10-FIL} + \text{PM-CON} &= \text{PM10-PRI} \\ \text{PM25-FIL} + \text{PM-CON} &= \text{PM25-PRI}\end{aligned}$$

- The following comparisons were made to determine consistency:

$$\begin{aligned}\text{PM10-PRI} &\geq \text{PM10-FIL} \\ \text{PM25-PRI} &\geq \text{PM25-FIL} \\ \text{PM10-PRI} &\geq \text{PM-CON} \\ \text{PM25-PRI} &\geq \text{PM-CON} \\ \text{PM10-FIL} &\geq \text{PM25-FIL} \\ \text{PM10-PRI} &\geq \text{PM25-PRI}\end{aligned}$$

If the data failed one of these checks it was diagnosed as an error. If a S/L/T agency did not provide corrections to these errors, the errors were corrected/filled according to an augmentation procedure explained in sections II.C.4 and II.C.5.

For information purposes, all PM-PRI and PM-FIL records were flagged to indicate that these pollutants were included instead of, or in addition to, the standard PM<sub>10</sub>, PM<sub>2.5</sub>, and PM-CON pollutants.

TX's area source inventory had many records that did not meet the PM consistency and completeness. Many of the errors occurred as a result of TX providing revisions on filterable emissions and not revising the primary emissions. Also, TX added daily filterable emissions for many categories but did not provide daily primary emissions. TX was consulted on how to resolve the PM issues and TX provided directions on how to correct the issues.

### Control Device Type and Control Efficiency Data Review

The control equipment codes in the “Primary Device Type Code” and “Secondary Device Type Code” fields were reviewed to identify invalid codes (i.e., codes that did not exist in the NIF 3.0 reference table) and missing codes (e.g., records with a null or uncontrolled code of 000 but with control efficiency data).

QA review of control efficiency data involved diagnosis of two types of errors. First, records were reviewed to identify control efficiency values that were reported as a decimal rather than as a percent value. Records with control efficiencies with decimal values were flagged as a potential error (although not necessarily an error, since the real control efficiency may be less than 1 percent). Records with a 1 percent control efficiency value were also identified for review by the S/L/T agency to determine if the value was reported as a decimal in its internal data system but rounded to 1 percent when the data were converted to NIF 3.0.

The second check identified records where 100 percent control was reported in the CE table, but the emissions in the EM table were greater than zero and the rule effectiveness value in the EM table was null, zero, or 100 percent (implying 100 percent control of emissions). Because many agencies did not populate the rule effectiveness field or a default value of zero was assigned, records with null or zero rule effectiveness values were included where the CE was 100 percent and emissions were greater than zero. For records that met these criteria, Pechan consulted with the S/L/T agency to determine if corrections were needed to any of the fields.

### Start and End Date Checks

The year in the start and end date values in the PE and EM tables were reviewed to confirm consistency with the inventory year in the transmittal table, and to confirm that the end date reported was greater than the start date reported.

### Annual and Daily Emissions Comparison

The S/L/T inventories were reviewed to determine if any of the following conditions existed:

- Multiple records coded at the SCC level as emission type 30, but with different start and end dates. While not a true duplicate, this may indicate an error or inclusion of both annual and seasonal values.
- Multiple records coded at the SCC level as a daily emission type (27, 29, etc.) but with different start and end dates. While not a true duplicate, this may indicate an error or just inclusion of additional types of daily emissions.
- Multiple records coded at the SCC level with the same start and end date, but different emission types. While not a true duplicate, this may indicate an error or just inclusion of additional types of daily emissions.

- Any “DAILY” type record that was missing its associated “ANNUAL” record was flagged for review.
- Any “DAILY” type record that was greater than its associated “ANNUAL” record was flagged for review.

### 3. Responses from S/L/T Agencies

The S/L/T agencies provided responses to questions about their data. The agencies or the Workgroups then provided direction for correcting the issues either by telephone or by e-mail. For AR and TX, QA issues were summarized in Excel spreadsheets and sent to the agencies, and the agencies provided their responses to the issues in the Excel spreadsheets. Table 7 identifies the files that document the QA issues and agency responses. The first spreadsheet in each QA Summary Report defines the remaining spreadsheets in the Excel Workbook file and provides instructions for communicating revisions.

**Table 7. QA Summary Reports for S/L/T Area Source Inventories**

| S/L/T Agency | Excel Workbook File Name of QA Summary Report |
|--------------|---|
| AR           | AR_QA_Report_060705.xls                       |
| TX           | TX_QA_Report_071405.xls                       |

### 4. Gap Filling and Augmentation

CENRAP-sponsored inventory data were added to the inventories as requested either by the S/L agencies or by the EI and Modeling Workgroups. Procedures for resolving issues with PM emissions in the comment files or to add PM emissions missing from the comment and Base A inventory files were resolved through consultation with the S/L agencies.

### 5. Revisions to Address Comments

The following details the revisions made to the Base A inventory:

#### *a. Arkansas*

#### **NH<sub>3</sub> Emissions**

To be consistent with the NH<sub>3</sub> categories included for the other CENRAP states, the following NH<sub>3</sub> categories in the CENRAP-sponsored area source inventory were added to the 2002 Base B inventory for AR:

| <u>SCC</u> | <u>SCC Description</u>                                 |
|------------|--|
| 2630020000 | Wastewater Treatment : Public Owned : Total Processed; |
| 2620030000 | Landfills : Municipal : Total;                         |
| 2806010000 | Domestic Animals Waste Emissions : Cats;               |
| 2806015000 | Domestic Animals Waste Emissions : Dogs;               |
| 2807020001 | Wild Animals Waste Emissions : Bears : Black Bears;    |



|            |   |
|------------|---|
| 2807020002 | Wild Animals Waste Emissions : Bears : Grizzly Bears; |
| 2807025000 | Wild Animals Waste Emissions : Elk; and               |
| 2807030000 | Wild Animals Waste Emissions : Deer.                  |

Emissions for grizzly bears are zero; but were included in the inventory for completeness.

#### **Agricultural Field Burning (SCCs starting with 2801500xxx)**

The Base A inventory contained VOC, CO, PM10-PRI, and PM25-PRI emissions provided by AR. At AR's request, AR's state inventory was replaced with the CENRAP-sponsored inventory. The activity data for the CENRAP-sponsored inventory were developed by surveying local agricultural extension service agents which are believed to provide better spatial and temporal resolution of agricultural field burning activity than the methods that were used for AR's inventory. This change provided data for SO<sub>2</sub>, NO<sub>x</sub>, and NH<sub>3</sub> not included in AR's inventory, but removed emissions from two counties (05017 and 05125) that had emissions in AR's inventory.

#### **Prescribed Burning for Forest Management (SCC 2810015000)**

The Base A inventory contained VOC, CO, PM10-PRI, and PM25-PRI emissions for this category. At AR's request, AR's state inventory was removed from the Base B area source inventory and replaced with the point source inventory developed by CENRAP. The CENRAP-sponsored planned burning inventory did not include any emissions for area sources. This change provided data for SO<sub>2</sub>, NO<sub>x</sub>, and NH<sub>3</sub> not included in AR's inventory

#### **Prescribed Burning of Rangeland (SCC 2810020000)**

The CENRAP-sponsored planned burning inventory contains point source emissions for VOC, CO, SO<sub>2</sub>, NO<sub>x</sub>, NH<sub>3</sub>, PM10-PRI, and PM25-PRI for 17 counties. This inventory was added to the Base B point source inventory.

#### **Wildfires (SCC 2810001000)**

The Base A inventory contained VOC, NO<sub>x</sub>, CO, PM10-PRI, and PM25-PRI emissions provided by AR, and NH<sub>3</sub> emissions estimated using a separate methodology based on the Carnegie Mellon University (CMU) Model (Version 6.1) defaults. AR decided to remove the NH<sub>3</sub> emissions from the area source inventory since the NH<sub>3</sub> emissions were not based on their state methodology.

#### *b. Minnesota*

MN provided an area source inventory on June 3, 2005. This inventory was used to update the Base A inventory for records where there was a match on the data key between the Base A inventory and MN's June 3 file.

In addition, for the Base A modeling effort, the Midwest RPO point source inventory for wildfires (SCC 2810001000) and agricultural field burning (SCC 2801500000) was to be used for MN, and, therefore, the area source emissions data for these two categories were removed. However, it was learned that the Midwest RPO point source inventory was not being used for modeling so the 2002 area source wildfire and agricultural field burning inventories were restored to the Base B inventory. The wildfire inventory included in the Base B area source inventory originates from the 2002 NEI. The agricultural field burning inventory included in the Base B area source inventory originates from the CENRAP-sponsored planned burning inventory.

*c. Texas*

TX provided comments on the draft 2002 NEI and requested that this comment file be used to update the CENRAP inventory. The comment file was obtained from EPA. The comment file was compared to both the CENRAP Base A inventory and the draft 2002 NEI. As a result, there were many issues identified for which TX provided clarification on how to resolve. The QA issues, comparison of the comments to the Base A inventory and the NEI, and TX's directions for resolving the QA issues are provided in several spreadsheets in the Excel workbook file (named TX\_QA\_Report\_071405.xls) provided with this report. After receiving TX's direction for resolving the QA issues, the submittal flags in the comments file were adjusted in order to apply the comments to the CENRAP's Base A inventory. The following provides a summary of the effects of TX's comments on the area source inventory:

- TX's comments file requested that the categories for unpaved roads (SCC 2296000000) and human perspiration (SCC 2810010000) be removed from the Base A inventory. However, since all of the other states include emissions for these categories, TX agreed that the categories should be kept in the inventory so these categories were removed from TX's comments file. The exception is that the area source inventory contained CO and VOC emissions for human perspiration for three counties that originated from the 1999 NEI. The NH<sub>3</sub> emissions for human perspiration are from the CENRAP-sponsored inventory and occur in all of TX's 254 counties. Therefore, per TX's request, the CO and VOC emissions were removed from the three counties.
- TX provided emissions for Mobile Sources : Highway Vehicles - Diesel : All HDDV including Buses (use subdivisions -071 thru -075 if possible) : Total: All Road Types (SCC 2230070000) that were not in the Base A inventory. The emissions for this category were added to the Base B inventory. It is not clear if the emissions for this category represent idling emissions or not. If they represent idling emissions, these emissions are not accounted for in the nonroad inventory, thus, there would be no double counting of emissions.
- For the Base A inventory, daily PM emissions were excluded from the area source inventory because of many PM consistency issues with the daily emissions. TX provided revisions to the daily emissions; however, after adding the daily emissions to the CENRAP inventory, many PM consistency issues were identified. In addition,

for several categories it was discovered that TX revised the annual and/or daily filterable emissions but not the primary emissions resulting in the primary emissions being less than the filterable emissions. A separate Excel workbook file is provided with this report that details the issues identified and explains how TX's PM emissions were adjusted to correct for inconsistencies in the reporting of PM emissions.

*d. EI and Modeling Workgroup Comments*

The EI and Modeling Workgroups requested the following revisions to the area source inventory:

**Natural Sources of NH<sub>3</sub> Emissions (SCCs starting with 27014xxxxx)**

To provide consistent source category coverage across the CENRAP states for natural sources of NH<sub>3</sub>, the emissions in the CENRAP-sponsored inventory for natural sources of NH<sub>3</sub> were added to the Base B inventory for AR, MN, and MO. The monthly emissions were summed to calculate annual emissions that were also added to the inventory for these three states. The emissions for these categories were already included in the area source inventory for the other CENRAP states.

**Onroad NH<sub>3</sub> Emissions**

Onroad NH<sub>3</sub> emissions for SCCs 2201001000 (Light Duty Gasoline Vehicles) and 2230001000 (Light Duty Diesel Vehicles) for IA, KS, and LA were removed from the area source inventory because the emissions for this category are included in CENRAP's onroad inventory.

**Stage II Refueling Emissions**

CENRAP revised the onroad inventory to include VOC emissions associated with Stage II refueling. Therefore, these emissions were removed from the area source inventory to avoid double-counting of emissions. The Stage II emissions removed from the area source inventory were classified under the following SCCs:

| <u>SCC</u> | <u>SCC Description</u>  |
|------------|---|
| 2501060100 | Storage and Transport : Petroleum and Petroleum Product Storage : Gasoline Service Stations : Stage 2: Total                          |
| 2501060101 | Storage and Transport : Petroleum and Petroleum Product Storage : Gasoline Service Stations : Stage 2: Displacement Loss/Uncontrolled |
| 2501060102 | Storage and Transport : Petroleum and Petroleum Product Storage : Gasoline Service Stations : Stage 2: Displacement Loss/Controlled   |
| 2501060103 | Storage and Transport : Petroleum and Petroleum Product Storage : Gasoline Service Stations : Stage 2: Spillage                       |

## **PM Consistency Issues**

It was discovered that the Oracle scripts run on the Base A area source inventory to identify cases where the PM10-PRI (PM25-PRI) emissions were less than the PM10-FIL (PM25-FIL) emissions did not work correctly. The scripts were corrected and tested and run on the Base B inventory. As a result, for the agricultural tilling emissions (SCC 2801000003) originating from the CENRAP-sponsored inventory, it was learned that when the Base A inventory was updated with the revised CENRAP-sponsored agricultural tilling inventory, the primary emissions got revised but the filterable emissions did not. Thus, in the Base B inventory, the filterable emissions have been revised to match the primary emissions.

### **6. QA Review of Final Inventory**

Final QA checks were run on the revised data set to ensure that all corrections provided by the S/L/T agencies were incorporated into the S/L/T inventories and that there were no remaining QA issues that could be addressed during the duration of the project. After exporting the inventory in Oracle to an Access database in NIF 3.0, the EPA's QA program was run on the Access database and the QA output was reviewed to verify that all QA issues that could be addressed were resolved (EPA, 2004a).

The output file from the EPA's QA program run on the area source inventory and the area miscellaneous source inventory is provided in an Access 2000 database along with the Access database containing the area and area miscellaneous inventory in NIF 3.0. The following lists the remaining QA issues that were not addressed during the duration of this project:

#### Area Source Inventory

Range Errors: There are 1,408 records in the EM table with emissions that exceed the maximum emissions in the QA program for the specified pollutant.

#### Area Miscellaneous Source Inventory

Range Errors: There is one EM record in MN for SCC 2701443000 with NH3 emissions that are significantly higher than the expected maximum emissions.

### **D. Nonroad Source Inventory Methods**

#### **1. Data Sources**

CENRAP revised its Base A inventory for the NONROAD model categories to correct the oxygen content model inputs as well as the default values used for the sulfur content of diesel. In addition, MN requested that the Midwest RPO Base J inventory be used in the revised CENRAP inventory. IA also requested that the Midwest RPO Base J inventory be used for agricultural equipment categories instead of the revised CENRAP inventory. TX, who is using its own inventory for both the Base A and B inventories, added emissions for oil field equipment. The inventories for the categories not included in the NONROAD model (i.e., aircraft,

commercial marine vessels, and locomotives) remained essentially unchanged from the Base A to the Base B inventory except for some revisions provided by TX.

The data files that the states provided for updating the Base A inventory were loaded into Oracle in NIF 3.0 into one data set. Then, the following updates were performed on the consolidated data set, if necessary:

- HAP records were removed since the inventory will support regional haze, fine PM, and ozone modeling.
- Pollutant codes were corrected to make them NIF 3.0 compliant (e.g., update PMPRI pollutant code to PM-PRI). Additionally, other codes were identified for remediation on a case-by-case basis.
- Records with a submittal flag indicating deletions (submittal\_flag = 'D' or 'RD') were removed from the inventory.
- Null values in the tribal code field were updated to '000' since this field is a part of the data key that defines records as unique in all eight NIF tables.
- Added and populated the NIF plus fields listed in the previous discussion for the area source inventory.
- The CENRAP-sponsored inventory did not contain S/L agency contact information in the TR table. Therefore, the TR table was updated to include the contact information that S/L agencies provided in their area source inventories.

## **2. QA Review**

QA review was conducted on the inventories in accordance with the QA procedures specified in the QAPP for this project (CENRAP, 2005b). The following discusses the QA checks that were completed during preparation of the consolidated data set.

### *a. County and SCC Coverage*

The county coverage in the state inventories appeared to be reasonable for all states. The SCC coverage was difficult to evaluate simply by showing a count of the number of SCCs by state. The EI and Modeling Workgroups reviewed summaries comparing the Base B to the Base A inventory.

### *b. Pollutant Coverage*

The pollutant coverage in the S/L/T inventories was complete for all pollutants after incorporating S/L comments.

*c. Additional QA for the CENRAP Nonroad Source Inventory*

The QA procedures discussed previously for the S/L/T area source inventories were applied to the nonroad inventory.

**3. Responses from S/L/T Agencies**

The S/L/T agencies provided responses to questions about their data. The agencies or the Workgroups then provided direction for correcting the issues either by telephone or by e-mail.

**4. Gap Filling and Augmentation**

CENRAP-sponsored inventory data were added to the inventories as requested either by the S/L agencies or by the EI and Modeling Workgroups.

**5. Revisions to Address Comments**

The following discusses the revisions made to the Base A nonroad inventory:

*a. Minnesota*

For the NONROAD model categories, MN elected to use the Base J inventory prepared by the Midwest RPO. This inventory includes monthly emissions. The monthly emissions were summed to calculate annual emissions, and records were added to the inventory to hold the annual emissions for supporting the development of emission summaries. The monthly emissions are used in the SMOKE IDA files for modeling.

The Midwest RPO Base J NONROAD model inventory was prepared by the state of WI. As a result, MN requested that the contact information for WI be listed in the TR table for MN.

*b. Iowa*

IA elected to use the CENRAP-sponsored inventory for all of the nonroad categories except for the following agricultural equipment categories:

| <u>SCC</u> | <u>SCC Description</u>   |
|------------|--|
| 22600050xx | Off-highway Vehicle Gasoline, 2-Stroke : Agricultural Equipment (2 SCCs);  |
| 22650050xx | Off-highway Vehicle Gasoline, 4-Stroke : Agricultural Equipment (11 SCCs); |
| 22670050xx | LPG : Agricultural Equipment (3 SCCs);                                     |
| 22680050xx | CNG : Agricultural Equipment (3 SCCs); and                                 |
| 22700050xx | Off-highway Vehicle Diesel : Agricultural Equipment (11 SCCs).             |

For the agricultural equipment categories, IA elected to use the Midwest RPO Base J inventory because this inventory provided improvements to the temporal allocation of emissions for the agricultural sector. The Base J inventory includes monthly emissions. The monthly emissions were summed to calculate annual emissions, and records were added to the inventory to hold the

annual emissions for supporting the development of emission summaries. The monthly emissions are used in the SMOKE IDA files for modeling.

*c. Texas*

**Oil Field Equipment Emissions**

TX provided annual and daily emissions for CO, CO<sub>2</sub>, NO<sub>x</sub>, VOC, SO<sub>2</sub>, PM10-FIL, and PM25-FIL for the following oil field equipment categories:

| <u>SCC</u> | <u>SCC Description</u>   |
|------------|--|
| 2265010010 | Off-highway Vehicle Gasoline, 4-Stroke : Industrial Equipment : Other Oil Field Equipment; |
| 2268010010 | CNG : Industrial Equipment : Other Oil Field Equipment; and                                |
| 2270010010 | Off-highway Vehicle Diesel : Industrial Equipment : Other Oil Field Equipment              |

These emissions were added to the Base B inventory. However, primary PM emissions are needed for the inventory. TX provided authorization to change the pollutant codes from PM10-FIL to PM10-PRI and PM25-FIL to PM25-PRI.

**Commercial Marine Vessels (SCC 2280000000)**

TX provided revisions to the NH<sub>3</sub> emissions for commercial marine vessels for 17 counties and the inventory was updated with the revised emissions.

**Railroad Locomotive Emissions (SCC 2285000000)**

The Base A inventory did not contain NH<sub>3</sub> emissions for this category in TX. TX provided the NH<sub>3</sub> emissions that were added to the Base B inventory.

*d. EI and Modeling Workgroup Comments*

**Correction for Double Counting of Emissions in Lancaster County, Nebraska**

Lancaster County provided its own nonroad inventory for SCC 2260000000 (Off-highway Vehicle Gasoline, 2-Stroke : 2-Stroke Gasoline except Rail and Marine: All). In the Base A inventory, the CENRAP-sponsored inventory provided emissions for the more detailed SCCs and were included in the Base A inventory. After reviewing the data and consulting with the local agency, the Workgroups decided to remove the CENRAP-sponsored inventory for SCCs starting with 226 in Lancaster County to remove double-counting of emissions.

**Revisions to the CENRAP-Sponsored Inventory**

For the categories included in the NONROAD model, all of the states elected to use the CENRAP-sponsored inventory in the Base B inventory except for MN and TX; IA for

agricultural equipment; and Lancaster County, NE for 2-stroke gasoline vehicles. The following discusses the changes made to the CENRAP-sponsored inventory.

### ***Revisions to Oxygen Content***

The CENRAP-sponsored inventory for the NONROAD model categories was updated during March 2005 to correct the fuel oxygenate content from decimal fraction to percentage values. As a result, the NONROAD model inventory for the states that elected to use the CENRAP-sponsored inventory was replaced with the new inventory.

### ***Revisions to Diesel Sulfur Content***

The input values used for the sulfur content of diesel fuel used in the revised CENRAP NONROAD model inventory were determined to be too low and the Workgroups decided to revise the input values for this parameter to be based on the default values used by the NONROAD model. The following explains the methods applied to adjust the SO<sub>2</sub>, PM<sub>10</sub>-PRI, and PM<sub>25</sub>-PRI emissions in the CENRAP-sponsored inventory based on adjustments to the sulfur content in diesel fuel.

The SO<sub>2</sub> emissions were adjusted by using the ratio of the new versus the original diesel sulfur content values, since the relationship of SO<sub>2</sub> to diesel fuel sulfur levels is linear. However, for PM<sub>10</sub>-PRI and PM<sub>25</sub>-PRI emissions, the adjustment is not a linear relationship. To estimate the impact of higher diesel fuel sulfur levels on PM<sub>10</sub>-PRI and PM<sub>25</sub>-PRI emissions for each state, national runs of the NONROAD model were performed using the original and new diesel fuel sulfur input values for each state.

Table 8 provides the original diesel fuel sulfur content values for seven of the CENRAP states. The NONROAD inventories for Minnesota and Texas and the agricultural equipment categories for IA were not revised because these States based their nonroad inventories on model runs that include the NONROAD model default sulfur values. The new diesel sulfur values are based on the NONROAD model default values. For diesel recreational marine engines (SCC 2282020005 and 2282020010), the NONROAD model uses a diesel sulfur content of 2,765 parts per million (ppm). For all other land-based diesel equipment, NONROAD incorporates a default diesel sulfur content of 2,457 ppm.

**Table 8. Original Diesel Fuel Content**

| <b>State</b> | <b>Original DIESEL SULFUR<br/>content, ppm</b> |
|--------------|--|
| KS           | 330.0  |
| AR           | 360.0  |
| IA           | 360.0  |
| NE           | 360.0  |
| OK           | 360.0  |
| LA           | 380.0  |
| MO           | 390.0  |



National NONROAD model runs were performed using the four unique sulfur levels in Table 8 (i.e., 330, 360, 380, and 390), and then two national NONROAD runs were performed using the default diesel fuel sulfur content values. The results of these runs were used to develop state-specific SCC-level ratios based on the resulting PM10-PRI and PM25-PRI emissions. The SCCs to which these ratios were applied to adjust emissions are shown in Table 9.

## **6. QA Review of Final Inventory**

Final QA checks were run on the revised data set to ensure that all corrections provided by the S/L/T agencies were incorporated into the S/L/T inventories and that there were no remaining QA issues that could be addressed during the duration of the project. After exporting the inventory in Oracle to an Access database in NIF 3.0, the EPA's QA program was run on the Access database and the QA output was reviewed to verify that all QA issues that could be addressed were resolved. The QA output is provided in an Access 2000 database along with the Access database containing the inventory in NIF 3.0.

The following lists the remaining QA issues that were not addressed during the duration of this project:

Range Errors: There are 230 records in the EM table with emissions that exceed the maximum emissions in the QA program for the specified pollutant.

Lookup Errors: There are 106,472 records in the EM table with CO<sub>2</sub> emissions that caused this error. CO<sub>2</sub> is not included in the reference table for valid NIF 3.0 pollutant codes. At the request of CENRAP, CO<sub>2</sub> emissions were kept in the inventory.

## **E. EGU 2018 Projection Year Inventory**

### **1. Introduction**

Pechan received from the Midwest RPO the 2018 IPM scenario file and extracted the data for each of the nine CENRAP states to post-process. Pechan post-processed the 2018 Integrated Planning Model (IPM) scenario data to create the mass emissions inventory for the SMOKE/IDA files. The post-processing procedure includes estimating emissions for CO, VOC, NH<sub>3</sub>, PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL, and PM-CON. Emissions for 21 temporal-pollutant combinations are estimated since there are seven pollutants and three temporal periods (summer season, winter season, July day). Note that annual SO<sub>2</sub> and annual, summer season, and July day NO<sub>x</sub> emission values are provided in the initial IPM scenario file. First, annual emission are estimated by applying an SCC-based pollutant-specific uncontrolled emission factor (that may include sulfur and/or ash content factor) to fuel quantity (that is obtained from the annual heat input provided in the IPM run and default fuel-based heat contents), control removal efficiency, and a units conversion factor.

**Table 9. NONROAD Diesel SCCs in the CENRAP-Sponsored Inventory for which the Sulfur Value will be adjusted to the NONROAD Model Default Value**

| <b>SCC*</b> | <b>SCC Description</b>  | <b>NONROAD Model Default Diesel Fuel S level, ppm**</b> |
|-------------|---|---|
| 2270001060  | Mobile Sources : Off-highway Vehicle Diesel : Recreational Equipment : Specialty Vehicles/Carts                 | 2457  |
| 2270002003  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Pavers                        | 2457  |
| 2270002006  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Tampers/Rammers               | 2457  |
| 2270002009  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Plate Compactors              | 2457  |
| 2270002015  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Rollers                       | 2457  |
| 2270002018  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Scrapers                      | 2457  |
| 2270002021  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Paving Equipment              | 2457  |
| 2270002024  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Surfacing Equipment           | 2457  |
| 2270002027  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Signal Boards/Light Plants    | 2457  |
| 2270002030  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Trenchers                     | 2457  |
| 2270002033  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Bore/Drill Rigs               | 2457  |
| 2270002036  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Excavators                    | 2457  |
| 2270002039  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Concrete/Industrial Saws      | 2457  |
| 2270002042  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Cement and Mortar Mixers      | 2457  |
| 2270002045  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Cranes                        | 2457  |
| 2270002048  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Graders                       | 2457  |
| 2270002051  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Off-highway Trucks            | 2457  |
| 2270002054  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Crushing/Processing Equipment | 2457  |
| 2270002057  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Rough Terrain Forklifts       | 2457  |
| 2270002060  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Rubber Tire Loaders           | 2457  |
| 2270002066  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Tractors/Loaders/Backhoes     | 2457  |
| 2270002069  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Crawler Tractor/Dozers        | 2457  |
| 2270002072  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Skid Steer Loaders            | 2457  |
| 2270002075  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Off-highway Tractors          | 2457  |
| 2270002078  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Dumpers/Tenders               | 2457  |
| 2270002081  | Mobile Sources : Off-highway Vehicle Diesel : Construction and Mining Equipment : Other Construction Equipment  | 2457  |
| 2270003010  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : Aerial Lifts                               | 2457  |
| 2270003020  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : Forklifts                                  | 2457  |
| 2270003030  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : Sweepers/Scrubbers                         | 2457  |
| 2270003040  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : Other General Industrial Equipment         | 2457  |
| 2270003050  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : Other Material Handling Equipment          | 2457  |
| 2270003060  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : AC\Refrigeration                           | 2457  |



**Table 9 (continued)**

| <b>SCC*</b> | <b>SCC Description</b>  | <b>NONROAD Model<br/>Default Diesel Fuel<br/>S level, ppm**</b> |
|-------------|---|---|
| 2270003070  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : Terminal Tractors                                    | 2457  |
| 2270004031  | Mobile Sources : Off-highway Vehicle Diesel : Lawn and Garden Equipment :<br>Leafblowers/Vacuums (Commercial)             | 2457  |
| 2270004036  | Mobile Sources : Off-highway Vehicle Diesel : Lawn and Garden Equipment :<br>Snowblowers (Commercial)                     | 2457  |
| 2270004046  | Mobile Sources : Off-highway Vehicle Diesel : Lawn and Garden Equipment : Front<br>Mowers (Commercial)                    | 2457  |
| 2270004056  | Mobile Sources : Off-highway Vehicle Diesel : Lawn and Garden Equipment : Lawn and<br>Garden Tractors (Commercial)        | 2457  |
| 2270004066  | Mobile Sources : Off-highway Vehicle Diesel : Lawn and Garden Equipment :<br>Chippers/Stump Grinders (Commercial)         | 2457  |
| 2270004071  | Mobile Sources : Off-highway Vehicle Diesel : Lawn and Garden Equipment : Turf<br>Equipment (Commercial)                  | 2457  |
| 2270004076  | Mobile Sources : Off-highway Vehicle Diesel : Lawn and Garden Equipment : Other Lawn<br>and Garden Equipment (Commercial) | 2457  |
| 2270005010  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : 2-Wheel Tractors                                   | 2457  |
| 2270005015  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Agricultural<br>Tractors                           | 2457  |
| 2270005020  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Combines   | 2457  |
| 2270005025  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Balers   | 2457  |
| 2270005030  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Agricultural<br>Mowers                             | 2457  |
| 2270005035  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Sprayers   | 2457  |
| 2270005040  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Tillers > 6 HP                                     | 2457  |
| 2270005045  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Swathers   | 2457  |
| 2270005050  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Hydro-power<br>Units                               | 2457  |
| 2270005055  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Other Agricultural<br>Equipment                    | 2457  |
| 2270005060  | Mobile Sources : Off-highway Vehicle Diesel : Agricultural Equipment : Irrigation Sets                                    | 2457  |
| 2270006005  | Mobile Sources : Off-highway Vehicle Diesel : Commercial Equipment : Generator Sets                                       | 2457  |
| 2270006010  | Mobile Sources : Off-highway Vehicle Diesel : Commercial Equipment : Pumps  | 2457  |
| 2270006015  | Mobile Sources : Off-highway Vehicle Diesel : Commercial Equipment : Air Compressors                                      | 2457  |
| 2270006025  | Mobile Sources : Off-highway Vehicle Diesel : Commercial Equipment : Welders  | 2457  |
| 2270006030  | Mobile Sources : Off-highway Vehicle Diesel : Commercial Equipment : Pressure<br>Washers                                  | 2457  |
| 2270007015  | Mobile Sources : Off-highway Vehicle Diesel : Logging Equipment : Forest Eqp -<br>Feller/Bunch/Skidder                    | 2457  |
| 2270008005  | Mobile Sources : Off-highway Vehicle Diesel : Airport Ground Support Equipment :<br>Airport Ground Support Equipment      | 2457  |
| 2270009010  | Mobile Sources : Off-highway Vehicle Diesel : Underground Mining Equipment : Other<br>Underground Mining Equipment        | 2457  |
| 2270010010  | Mobile Sources : Off-highway Vehicle Diesel : Industrial Equipment : Other Oil Field<br>Equipment                         | 2457  |
| 2282020005  | Mobile Sources : Pleasure Craft : Diesel : Inboard/Stern-drive  | 2765  |
| 2282020010  | Mobile Sources : Pleasure Craft : Diesel : Outboard   | 2765  |
| 2285002015  | Mobile Sources : Railroad Equipment : Diesel : Railway Maintenance  | 2457  |

\* Unique list of SCCs is from CENRAP-sponsored inventory for all States except MN and TX.

\*\* Marine diesel fuel S level assumed higher than land-based diesel fuel.

To obtain the needed temporal emissions, summer season emissions are estimated by multiplying the annual emissions by a ratio of the summer season to annual heat input; winter season emissions are estimated by subtracting the summer season emissions from the annual emissions; and summer day emissions are estimated by multiplying the annual emissions by a ratio of the July day to annual heat input.

Table 10 presents the CO, VOC, NH<sub>3</sub>, PM10-FIL, and PM25-FIL emission factors by SCC. Table 11 presents the PM-CON emission factors by SCC. For PM10-FIL and PM25-FIL, control efficiencies (that are obtained using an EPA-approved method) are applied to the uncontrolled emissions. PM-CON is estimated using heat input (included in the IPM run) and emissions factors. PM10-PRI (and PM25-PRI) are obtained by summing PM-CON and PM10-FIL (PM-CON and PM25-FIL) emissions.

The post-processing methodology also includes the following steps:

Step 1: Adding data for all units.

SCCs were assigned for all units; unit/fuel/firing/bottom type data were used for existing units' assignments, while only unit and fuel type were used for generic units' assignments. Latitude-longitude coordinates were assigned, first using the EPA-provided data files, secondly using the September 17, 2004 Pechan in-house latitude-longitude file, and lastly using county centroids. These data were only used when the data were not provided in the 2002 NIF files. Stack parameters were attached, first using the EPA-provided data files, secondly using a March 9, 2004 Pechan in-house stack parameter file based on previous EIA-767 data, and lastly using an EPA June 2003 SCC-based default stack parameter file. These data were only used when the data were not provided in the 2002 NIF files. Plant ID (within State and county), point ID, process ID, and stack ID were then attached, first using the EPA-provided data files, or secondly using Pechan-generated defaults: the point ID is assigned the value of the given boiler ID preceded by '#', unless the boiler ID has a length of six [the length for the point ID], in which case the left-most character is replaced with '#'; and the default Pechan process ID is '01'. Default stack IDs within a plant are assigned for each unique stack height-diameter combination; the default Pechan stack ID is of the form '4N'. The process ID and stack ID default data were only used when the data were not provided.

**Table 10. SCC-Based Uncontrolled Emission Factors (EF) for Electricity  
Generating Units**

| SCC      | CO EF   | VOC EF  | NH3 EF   | PM10-FIL EF    | PM25-FIL EF    | PM<br>FLAG <sup>1</sup> |
|----------|---------|---------|----------|----------------|----------------|-------------------------|
| 10100101 | 0.6000  | 0.0700  | 0.030000 | 2.3000         | 0.6000         | A                       |
| 10100102 | 0.6000  | 0.0700  | 0.030000 | 4.8000         | 2.5000         |                         |
| 10100201 | 0.5000  | 0.0400  | 0.030000 | 2.6000         | 1.4800         | A                       |
| 10100202 | 0.5000  | 0.0600  | 0.030000 | 2.3000         | 0.6000         | A                       |
| 10100203 | 0.5000  | 0.1100  | 0.030000 | 0.2600         | 0.1100         | A                       |
| 10100204 | 5.0000  | 0.0500  | 0.030000 | 13.2000        | 4.6000         |                         |
| 10100205 | 6.0000  | 0.0500  | 0.030000 | 6.0000         | 2.2000         |                         |
| 10100211 | 0.5000  | 0.0400  | 0.030000 | 2.6000         | 1.4800         | A                       |
| 10100212 | 0.5000  | 0.0600  | 0.030000 | 2.3000         | 0.6000         | A                       |
| 10100215 | 0.5000  | 0.0600  | 0.030000 | 2.3000         | 0.6000         | A                       |
| 10100217 | 18.0000 | 0.0500  | 0.030000 | 12.4000        | 1.3640         |                         |
| 10100218 | 18.0000 | 0.0500  | 0.030000 | 12.4000        | 1.3640         |                         |
| 10100221 | 0.5000  | 0.0400  | 0.030000 | 2.6000         | 1.4800         | A                       |
| 10100222 | 0.5000  | 0.0600  | 0.030000 | 2.3000         | 0.6000         | A                       |
| 10100223 | 0.5000  | 0.1100  | 0.030000 | 0.2600         | 0.1100         | A                       |
| 10100224 | 5.0000  | 0.0500  | 0.030000 | 13.2000        | 4.6000         |                         |
| 10100225 | 6.0000  | 0.0500  | 0.030000 | 6.0000         | 2.2000         |                         |
| 10100226 | 0.5000  | 0.0600  | 0.030000 | 2.3000         | 0.6000         | A                       |
| 10100235 | 0.5000  | 0.0600  | 0.030000 | 2.3000         | 0.6000         | A                       |
| 10100237 | 18.0000 | 0.0500  | 0.030000 | 16.1000        | 4.2000         |                         |
| 10100238 | 18.0000 | 0.0500  | 0.030000 | 16.1000        | 4.2000         |                         |
| 10100300 | -9.0000 | -9.0000 | 0.030000 | -9.0000        | -9.0000        |                         |
| 10100301 | 0.2500  | 0.0700  | 0.030000 | 1.8170         | 0.5214         | A                       |
| 10100302 | 0.6000  | 0.0700  | 0.030000 | 2.3000         | 0.6600         | A                       |
| 10100303 | 0.6000  | 0.0700  | 0.030000 | 0.8710         | 0.3690         | A                       |
| 10100304 | 6.0000  | 0.0700  | 0.030000 | 1.0700         | 0.4066         | A                       |
| 10100306 | 5.0000  | 0.0700  | 0.030000 | 1.6000         | 0.5600         | A                       |
| 10100316 | 0.1500  | 0.0300  | 0.030000 | 12.0000        | 1.4000         |                         |
| 10100317 | 0.1500  | 0.0300  | 0.030000 | 12.0000        | 1.4000         |                         |
| 10100318 | 0.1500  | 0.0300  | 0.030000 | 12.0000        | 1.4000         |                         |
| 10100401 | 5.0000  | 0.7600  | 0.800000 | See Footnote 2 | See Footnote 3 |                         |
| 10100404 | 5.0000  | 0.7600  | 0.800000 | See Footnote 2 | See Footnote 3 |                         |
| 10100405 | 5.0000  | 0.7600  | 0.800000 | 5.9000         | 4.3000         | A                       |
| 10100406 | 5.0000  | 0.7600  | 0.800000 | 5.9000         | 4.3000         | A                       |
| 10100501 | 5.0000  | 0.2000  | 0.800000 | 1.0000         | 0.2500         |                         |
| 10100504 | 5.0000  | 0.7600  | 0.800000 | 5.9000         | 4.3000         | A                       |
| 10100505 | 5.0000  | 0.7600  | 0.800000 | 5.0000         | 3.6000         |                         |
| 10100601 | 84.0000 | 5.5000  | 3.200000 | 1.9000         | 1.9000         |                         |
| 10100602 | 84.0000 | 5.5000  | 3.200000 | 1.9000         | 1.9000         |                         |
| 10100604 | 24.0000 | 5.5000  | 3.200000 | 1.9000         | 1.9000         |                         |
| 10100602 | 81.0400 | 5.3062  | 3.200000 | 1.8330         | 1.8330         |                         |
| 10100701 | 6.5718  | 0.4303  | 1.200000 | 0.1486         | 0.1486         |                         |
| 10100702 | 6.5718  | 0.4303  | 1.200000 | 0.1486         | 0.1486         |                         |
| 10100702 | 67.5644 | 4.4239  | 1.200000 | 1.5282         | 1.5282         |                         |
| 10100703 | 66.9620 | 4.3844  | 1.200000 | 1.5146         | 1.5146         |                         |
| 10100704 | 6.8064  | 0.4457  | 1.200000 | 0.1540         | 0.1540         |                         |
| 10100707 | 41.0024 | 2.6847  | 1.200000 | 0.9274         | 0.9274         |                         |
| 10100711 | 32.0274 | 2.0970  | 1.200000 | 0.7244         | 0.7244         |                         |
| 10100712 | 49.8809 | 3.2660  | 1.200000 | 1.1283         | 1.1283         |                         |

**Table 10 (continued)**

| SCC      | CO EF    | VOC EF   | NH3 EF    | PM10-FIL EF | PM25-FIL EF | PM<br>FLAG <sup>1</sup> |
|----------|----------|----------|-----------|-------------|-------------|-------------------------|
| 10100801 | 0.6000   | 0.0700   | 0.397000  | 7.9000      | 4.5000      | A                       |
| 10100818 | 18.0000  | 0.0500   | 0.397000  | 12.4000     | 1.3640      |                         |
| 10100901 | 6.8459   | 0.1940   | 0.086000  | 5.7049      | 4.9062      |                         |
| 10100902 | 6.8459   | 0.1940   | 0.086000  | 5.7049      | 4.9062      |                         |
| 10100903 | 6.8459   | 0.1940   | 0.086000  | 4.1075      | 3.5370      |                         |
| 10100911 | 13.6000  | 0.1940   | 0.086000  | 5.7049      | 4.9062      |                         |
| 10100912 | 1.4000   | 0.1940   | 0.086000  | 5.7049      | 4.9062      |                         |
| 10101001 | 3.6000   | 0.2600   | -9.000000 | 0.6000      | 0.6000      |                         |
| 10101001 | 269.6000 | 17.6524  | -9.000000 | 6.0981      | 6.0981      |                         |
| 10101002 | 67.5644  | 4.4239   | -9.000000 | 4.6867      | 4.6867      |                         |
| 10101002 | 207.2000 | 13.5667  | -9.000000 | 0.1636      | 0.1636      |                         |
| 10101101 | 2.0000   | 2.0000   | -9.000000 | 12.3200     | 7.0200      |                         |
| 10101201 | 1.2992   | 0.7218   | 1.190000  | 22.8089     | 12.9924     |                         |
| 10101201 | 0.0165   | 2.0000   | 1.190000  | 11.4000     | 7.8000      |                         |
| 10101202 | 3.6000   | 2.0000   | 1.190000  | 63.2000     | 36.0000     |                         |
| 10101204 | 0.5000   | 0.0600   | 1.190000  | 2.3000      | 0.6000      | A                       |
| 10101205 | 0.3958   | 0.2199   | 1.190000  | 6.9484      | 3.9580      |                         |
| 10101206 | 0.6000   | 0.1700   | 1.190000  | 15.6000     | 15.6000     |                         |
| 10101207 | 0.8741   | 0.4856   | 1.190000  | 15.3452     | 8.7408      |                         |
| 10101208 | 6.8459   | 0.1940   | 1.190000  | 5.7049      | 4.9062      |                         |
| 10101301 | 3.7232   | 0.1489   | -9.000000 | 0.7446      | 0.1862      |                         |
| 10101301 | 5.0000   | 1.0000   | -9.000000 | 51.0000     | 13.0000     | A                       |
| 10101301 | 0.2857   | 0.0114   | -9.000000 | 0.0571      | 0.0143      |                         |
| 10101302 | 5.0000   | 1.0000   | -9.000000 | 33.1500     | 18.7200     |                         |
| 10101304 | 0.7627   | 0.4237   | -9.000000 | 13.3898     | 7.6271      |                         |
| 10101305 | 1.1179   | 0.0447   | -9.000000 | 0.2236      | 0.0559      |                         |
| 10101306 | 1.6071   | 0.0643   | -9.000000 | 0.3214      | 0.0804      |                         |
| 10101307 | 4.4571   | 0.1783   | -9.000000 | 0.8914      | 0.2229      |                         |
| 10101308 | 1.1316   | 0.0453   | -9.000000 | 0.2263      | 0.0566      |                         |
| 10101601 | 0.3464   | 0.0139   | -9.000000 | 0.0693      | 0.0173      |                         |
| 10101801 | 0.0000   | 0.0000   | -9.000000 | 0.0000      | 0.0000      |                         |
| 10101901 | 0.5000   | 0.0600   | 0.030000  | 2.3000      | 0.6000      | A                       |
| 10102001 | 0.2500   | 0.0700   | 0.030000  | 1.8170      | 0.5214      | A                       |
| 10102018 | 0.1500   | 0.0300   | 0.030000  | 12.0000     | 1.4000      |                         |
| 10102101 | 5.0000   | 0.2000   | -9.000000 | 1.0000      | 0.2500      |                         |
| 20100101 | 0.4598   | 0.0571   | 6.620000  | 0.6020      | 0.6020      |                         |
| 20100102 | 130.0000 | 0.0570   | 6.620000  | 6.8000      | 6.5500      |                         |
| 20100201 | 83.8628  | 2.1477   | 6.560000  | 1.9380      | 1.9380      |                         |
| 20100202 | 399.0000 | 116.0000 | 0.600000  | 10.0000     | 10.0000     |                         |
| 20100301 | 34.6500  | 2.2050   | 6.560000  | 11.5500     | 11.5500     |                         |
| 20100901 | 0.4455   | 2.3800   | -9.000000 | 8.5400      | 8.5400      |                         |
| 20100902 | 128.2500 | 49.3000  | -9.000000 | 41.8500     | 41.8500     |                         |

<sup>1</sup> A means the ash content (percentage value) of the fuel is multiplied by the emission factor value shown in this table.

<sup>2</sup> From Factor Information and Retrieval (FIRE) 6.24, the equation for this PM10-FIL EF is  $[5.9 \cdot (1.12 \cdot S + 0.37)]$ .

<sup>3</sup> From FIRE 6.24, the equation for this PM25-FIL EF is  $[4.3 \cdot (1.12 \cdot S + 0.37)]$ .

Note that (1) -9 indicates that an emission factor is not available for the SCC and pollutant combination; and (2) for SCCs beginning with 101001, 101002, or 101003 (coal), 101008 (coke), 101009 (wood), 101011 (bagasse), 101012 (solid waste), 101019 (synfuel), 101020 (waste coal), or 101012 (agr. byproduct), emission factors are in pounds per ton; for SCCs beginning with 101004, 101005, and 201001 (oil), 101010 (propane/butane), 101013 (liquid waste), 101016 (methanol), 101021 (other oil), or 201009 (kerosene/jet fuel), emission factors are in pounds per thousand gallons; for SCCs beginning with 101006 or 201002 (natural gas), 101007 (process gas), 101018 (hydrogen), or 201003 (IGCC) emission factors are in pounds per million cubic feet.

**Table 11. PM Condensable Emissions Factors (EF) for Electricity Generating Units**

| <b>Fuel</b>  | <b>Applicable Source Classification Codes</b>  | <b>PM Condensable Emission Factor (PM<sub>CDEF</sub>) in lb/MMBtu</b> |
|--|--|---|
| Coal (including waste coal and syn coal)*            | 10100204, 10100205, 10100224, 10100225, 10100304, 10100306   | 0.0400  |
|  | 10100217, 10100218, 10100237, 10100238, 10100317, 10100318, 10102018   | 0.0100  |
|  | 10100201, 10100202, 10100203, 10100212, 10100221, 10100222, 10100223, 10100226, 10100301, 10100302, 10100303, 10101901, 10102001 | 0.02**  |
|  | 10100201, 10100202, 10100203, 10100212, 10100221, 10100222, 10100223, 10100226, 10100301, 10100302, 10100303, 10101901, 10102001 | (0.1 * sulfur content [as a decimal] - .03)***                        |
| Light Oil (Distillate, Diesel)                       | 10100401 - 10100499  | 0.0100  |
| Heavy Oil (Residual)                                 | 10100501 - 10100599  | 0.0090  |
| Natural Gas  | 10100601 - 10100699  | 0.0057  |
| Other Process Gases                                  | 10100701 - 10100799  | 0.0056  |
| Petroleum Coke                                       | 10100801 - 10100899  | 0.0100  |
| Wood, Biomass (including Black Liquor), Waste/Refuse | 10100901 - 10100999, 10101201 - 10101299, 10101304   | 0.0170  |
| LPG (Propane, Butane)                                | 10101001 - 10101099  | 0.0056  |
| Other Liquid Waste/Oil, Methanol                     | 10101301, 10101302, 10101305, 10101306, 0101307, 10101308, 10102101, 10101601  | 0.0090  |

\* If the emission factor is less than 0.01, then it is set equal to 0.01.

\*\* AND there is either an SO<sub>2</sub> FGD or a PM wet scrubber.

\*\*\* And there is any PM control other than a wet scrubber and there is no SO<sub>2</sub> control, OR SCC = 10100222 and there is no PM control.

Note that PM<sub>10</sub>-PRI = PM<sub>10</sub>-FIL + PM-CON and PM<sub>25</sub>-PRI = PM<sub>25</sub>-FIL + PM-CON.



Step 2: Siting generic units using an EPA-approved electronic method.

Generic aggregates, which consist of IPM-designated “planned/committed” units as well as “new” units produced by the IPM model are transformed into units similar to the existing units in terms of the available data. The generic aggregates are split into smaller generic units based on their unit types and capacity, are provided a dummy ORIS unique plant and boiler ID, and are given a county FIPS code based on an algorithm that sites each generic by assigning a sister plant that is in a county based on its attainment/nonattainment status. Within a state, plants (in county then ORIS plant code order) in attainment counties are used first as sister sites to generic units, followed by plants in PM nonattainment counties (as of January 2004), followed by plants in 8-hour ozone nonattainment counties (as of April 2004).

Step 3: Deriving defaults using the same methodology previously approved by the Midwest RPO and Visibility Improvement State and Tribal Association of the Southeast (VISTAS).

Additional data were required for estimating VOC, CO, PM10-FIL, PM25-FIL, PM-CON, and NH<sub>3</sub> emissions for all units. Thus, ash and sulfur contents were assigned by first using 2002 EIA-767 values for existing units or SCC-based defaults; PM10-FIL and PM25-FIL efficiencies were obtained from the 2002 EGU NEI that were based on 2002 EIA-767 control data and the PM Calculator program (a default of 99.2 percent is used for coal units if necessary); fuel use was back calculated from the given heat input and a default SCC-based heat content; and emission factors were obtained from an EPA-approved October 7, 2004 Pechan emission factor file based on AP-42 emission factors. Note that this updated file is not the one used for estimating emissions for previous EPA post-processed IPM files.

Step 4: Adding in S/L agency emissions inventory identifiers from the updated CENRAP crosswalk.

The previous crosswalk file was compared to the Base B point source inventory and updated to as needed to ensure correct matching of the codes in the IPM file to state IDs in the NIF 3.0 inventory file. The revised crosswalk file was then used to obtain state and county FIPS codes, plant IDs (within State and county), and point IDs. If the state and county FIPS codes, plant IDs and point IDs were in the 2002 NIF tables, then the process IDs and stack IDs were obtained from the NIF; otherwise, defaults, described above, were used.

Step 5: Transforming the data into annual SMOKE/IDA formatted text files for use by the modelers (see section II.E.4).

## **2. Data Sources**

There are several data sources used during the post-processing procedure. These include the following:

- § Records from the nine CENRAP states from one Midwest RPO/VISTAS IPM “second round” parsed file, VISTASII\_PC\_1f\_FossilUnits\_2018 (To Client).xls

- \$ The updated CENRAP crosswalk
- \$ Two EPA-approved emissions factor in-house file (Tables 10 and 11) for estimating annual VOC, CO, NH<sub>3</sub>, PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL, and PM-CON emissions
- \$ Other files used in previous IPM run post-processing (e.g., power plant latitude-longitude file, SCC assignment file, fuel-based heat content file, EIA-767-based stack parameters file, and EPA-approved default stack parameters file).

### **3. QA Review**

Pechan performed QA of the inventory by extracting the records for the CENRAP states from the 2018 IPM run and then checking to verify that all of the records are included in the CENRAP crosswalk and, if not, flagging them so that they are properly accounted for in the post-processing. After the post-processing was completed, and the data were transformed into their proper format, Pechan compared the initial (from the IPM file) and final (from the SMOKE/IDA files) NO<sub>x</sub> emission tons -- annual [summer plus winter season], summer season, summer day -- and SO<sub>2</sub> annual [summer plus winter season] emission tons -- for each State and for the nine State total to ascertain that they did not change values; they did not.

### **4. SMOKE/IDA Files**

The 2018 inventory was formatted as SMOKE/IDA summer and winter files. The file structures are delineated in Tables 12 and 13.

### **5. Emissions Summary**

Table 14 provides a summary of the summer season, summer day, and winter season emissions calculated for the 2018 EGU inventory and included in the SMOKE IDA files.

**Table 12. CENRAP SMOKE/IDA Summer Season File Structure**

| Position | Name     | Type | Description  | Width | Max Decimals | Blanked         |
|----------|----------|------|--|-------|--------------|-----------------|
| 1-2      | STID     | Int  | State Code   | 2     |              |                 |
| 3-5      | CYID     | Int  | County Code  | 3     |              |                 |
| 6-20     | PLANTID  | Char | Plant Identification Code (default value = "ORIS" + value of ORISID)         | 15    |              |                 |
| 21-35    | POINTID  | Char | Point Identification Code (default value = "#" + value of BLRID)             | 15    |              |                 |
| 36-47    | STACKID  | Char | Stack Identification Code <sup>1</sup>                                       | 12    |              |                 |
| 48-53    | ORISID   | Char | DOE Plant ID   | 6     |              |                 |
| 54-59    | BLRID    | Char | Boiler Identification Code   | 6     |              |                 |
| 60-61    | SEGMENT  | Char | DOE ID <sup>2</sup>  | 2     |              |                 |
| 62-101   | PLANT    | Char | Plant Name   | 40    |              |                 |
| 102-111  | SCC      | Char | SCC (SCC used in IPM to calculate emissions)                                 | 10    |              | If summed units |
| 112-115  | BEGYR    | Int  | Beginning Year of Unit Operation   | 4     |              | Y               |
| 116-119  | ENDYR    | Int  | Ending Year of Unit Operation  | 4     |              | Y               |
| 120-123  | STKHGT   | Real | Stack Height (ft)  | 4     | 3            |                 |
| 124-129  | STKDIAM  | Real | Stack Diameter (ft)  | 6     | 5            |                 |
| 130-133  | STKTEMP  | Real | Stack Gas Exit Temperature ( degree F)                                       | 4     | 3            |                 |
| 134-143  | STKFLOW  | Real | Stack Gas Flow Rate (ft <sup>3</sup> /s)                                     | 10    | 9            |                 |
| 144-152  | STKVEL   | Real | Stack Gas Exit Velocity (ft/s)   | 9     | 8            |                 |
| 153-160  | BOILCAP  | Real | Design Capacity (MMBtu/hr)   | 8     | 0            | Y               |
| 161-161  | CAPUNITS | Char | Capacity Unit Code   | 1     |              | Y               |
| 162-163  | WINTHRU  | Real | Winter throughput (% of Annual)  | 2     | 0            | Y               |
| 164-165  | SPRTHRU  | Real | Spring throughput (% of Annual)  | 2     | 0            | Y               |
| 166-167  | SUMTHRU  | Real | Summer throughput (% of Annual)  | 2     | 0            | Y               |
| 168-169  | FALTHRU  | Real | Fall throughput (% of Annual)  | 2     | 0            | Y               |
| 170-171  | HOURS    | Int  | Normal Operating Time (hr/day)   | 2     |              | Y               |
| 172-173  | START    | Int  | Normal Operation Start Time  | 2     |              | Y               |
| 174-174  | DAYS     | Int  | Normal Operating Time (days/wk)  | 1     |              | Y               |
| 175-176  | WEEKS    | Int  | Normal Operating Time (wk/yr)  | 2     |              | Y               |
| 177-187  | THRUPUT  | Real | Throughput Rate (SCC units/yr)   | 11    | 0            | Y               |
| 188-199  | MAXRATE  | Real | Maximum O <sub>3</sub> Season Rate (units/day)                               | 12    | 0            | Y               |
| 200-207  | HEATCON  | Real | Heat Content (MMBtu/SCC unit)  | 8     | 0            | Y               |
| 208-212  | SULFCON  | Real | Sulfur Content (mass percent)  | 5     | 0            | Y               |
| 213-217  | ASHCON   | Real | Ash Content (mass percent)   | 5     | 0            | Y               |
| 218-226  | NETDC    | Real | Maximum Nameplate Capacity (MW)  | 9     | 0            | Y               |
| 227-230  | SIC      | Int  | Standard Industrial Classification Code (SIC) <sup>3</sup>                   | 4     |              |                 |
| 231-239  | LATC     | Real | Latitude (decimal degrees)   | 9     | 4            |                 |
| 240-248  | LONC     | Real | Longitude (decimal degrees)  | 9     | 4            |                 |
| 249-249  | OFFSHORE | Char | Offshore Flag  | 1     |              | Y               |
| 250-262  | SUMCO    | Real | CO Summer Season Emissions (short tons/season)                               | 13    | 12           |                 |
| 263-275  | AVDCO    | Real | CO Average Summer Day Emissions (short tons/average season day)              | 13    | 12           |                 |
| 276-282  | CE1      | Real | CO Control Efficiency  | 7     | 0            | Y               |
| 283-285  | RE1      | Real | CO Rule Effectiveness  | 3     | 0            | Y               |
| 286-295  | EMF1     | Real | CO Emission Factors (SCC units)  | 10    | 0            | Y               |
| 296-298  | CPRI1    | Int  | CO Primary Control Equipment Code  | 3     |              | Y               |
| 299-301  | CSEC1    | Int  | CO Secondary Control Equipment Code  | 3     |              | Y               |
| 302-314  | SUMNH3   | Real | NH <sub>3</sub> Summer Season Emissions (short tons/season)                  | 13    | 12           |                 |
| 315-327  | AVDNH3   | Real | NH <sub>3</sub> Average Summer Day Emissions (short tons/average season day) | 13    | 12           |                 |
| 328-334  | CE2      | Real | NH <sub>3</sub> Control Efficiency   | 7     | 0            | Y               |
| 335-337  | RE2      | Real | NH <sub>3</sub> Rule Effectiveness   | 3     | 0            | Y               |
| 338-347  | EMF2     | Real | NH <sub>3</sub> Emission Factors (SCC units)                                 | 10    | 0            | Y               |
| 348-350  | CPRI2    | Int  | NH <sub>3</sub> Primary Control Equipment Code                               | 3     |              | Y               |
| 351-353  | CSEC2    | Int  | NH <sub>3</sub> Secondary Control Equipment Code                             | 3     |              | Y               |
| 354-366  | SUMNOX   | Real | NO <sub>x</sub> Summer Season Emissions (short tons/season)                  | 13    | 12           |                 |

**Table 12 (continued)**

| Position | Name    | Type | Description  | Width | Max Decimals | Blanked |
|----------|---------|------|--|-------|--------------|---------|
| 367-379  | AVDNOX  | Real | NO <sub>x</sub> Average Summer Day Emissions (short tons/average season day)           | 13    | 12           |         |
| 380-386  | CE3     | Real | NO <sub>x</sub> Control Efficiency   | 7     | 0            | Y       |
| 387-389  | RE3     | Real | NO <sub>x</sub> Rule Effectiveness   | 3     | 0            | Y       |
| 390-399  | EMF3    | Real | NO <sub>x</sub> Emission Factors (SCC units)   | 10    | 0            | Y       |
| 400-402  | CPRI3   | Int  | NO <sub>x</sub> Primary Control Equipment Code   | 3     |              | Y       |
| 403-405  | CSEC3   | Int  | NO <sub>x</sub> Secondary Control Equipment Code                                       | 3     |              | Y       |
| 406-418  | SUMPM10 | Real | Primary PM <sub>10</sub> Summer Season Emissions (short tons/season)                   | 13    | 12           |         |
| 419-431  | AVDPM10 | Real | Primary PM <sub>10</sub> Average Summer Day Emissions (short tons/average season day)  | 13    | 12           |         |
| 432-438  | CE4     | Real | Primary PM <sub>10</sub> Control Efficiency  | 7     | 0            | Y       |
| 439-441  | RE4     | Real | Primary PM <sub>10</sub> Rule Effectiveness  | 3     | 0            | Y       |
| 442-451  | EMF4    | Real | Primary PM <sub>10</sub> Emission Factors (SCC units)                                  | 10    | 0            | Y       |
| 452-454  | CPRI4   | Int  | Primary PM <sub>10</sub> Primary Control Equipment Code                                | 3     |              | Y       |
| 455-457  | CSEC4   | Int  | Primary PM <sub>10</sub> Secondary Control Equipment Code                              | 3     |              | Y       |
| 458-470  | SUMPM25 | Real | Primary PM <sub>2.5</sub> Summer Season Emissions (short tons/season)                  | 13    | 12           |         |
| 471-483  | AVDPM25 | Real | Primary PM <sub>2.5</sub> Average Summer Day Emissions (short tons/average season day) | 13    | 12           |         |
| 484-490  | CE5     | Real | Primary PM <sub>2.5</sub> Control Efficiency   | 7     | 0            | Y       |
| 491-493  | RE5     | Real | Primary PM <sub>2.5</sub> Rule Effectiveness   | 3     | 0            | Y       |
| 494-503  | EMF5    | Real | Primary PM <sub>2.5</sub> Emission Factors (SCC units)                                 | 10    | 0            | Y       |
| 504-506  | CPRI5   | Int  | Primary PM <sub>2.5</sub> Primary Control Equipment Code                               | 3     |              | Y       |
| 507-509  | CSEC5   | Int  | Primary PM <sub>2.5</sub> Secondary Control Equipment Code                             | 3     |              | Y       |
| 510-522  | SUMSO2  | Real | SO <sub>2</sub> Summer Season Emissions (short tons/season)                            | 13    | 12           |         |
| 523-535  | AVDSO2  | Real | SO <sub>2</sub> Average Summer Day Emissions (short tons/average season day)           | 13    | 12           |         |
| 536-542  | CE6     | Real | SO <sub>2</sub> Control Efficiency   | 7     | 0            | Y       |
| 543-545  | RE6     | Real | SO <sub>2</sub> Rule Effectiveness   | 3     | 0            | Y       |
| 546-555  | EMF6    | Real | SO <sub>2</sub> Emission Factors (SCC units)   | 10    | 0            | Y       |
| 556-558  | CPRI6   | Int  | SO <sub>2</sub> Primary Control Equipment Code   | 3     |              | Y       |
| 559-561  | CSEC6   | Int  | SO <sub>2</sub> Secondary Control Equipment Code                                       | 3     |              | Y       |
| 562-574  | SUMVOC  | Real | VOC Summer Season Emissions (short tons/season)  | 13    | 12           |         |
| 575-587  | AVDVOC  | Real | VOC Average Summer Day Emissions (short tons/average season day)                       | 13    | 12           |         |
| 588-594  | CE7     | Real | VOC Control Efficiency   | 7     | 0            | Y       |
| 595-597  | RE7     | Real | VOC Rule Effectiveness   | 3     | 0            | Y       |
| 598-607  | EMF7    | Real | VOC Emission Factors (SCC units)   | 10    | 0            | Y       |
| 608-610  | CPRI7   | Int  | VOC Primary Control Equipment Code   | 3     |              | Y       |
| 611-613  | CSEC7   | Int  | VOC Secondary Control Equipment Code   | 3     |              | Y       |

1. Selected from the NIF EM table using corresponding segment ID from using the segment ID selection process. Defaults taken from IPM process and are either from EPA approved files or are Pechan defaults (41, 42, 43, etc).
2. Segment ID selection process used to determine which ID is used. Process consists of taken the segment ID from the NIF EM table with the highest emissions. Only the seven relevant pollutants are used and follow a hierarchy of NO<sub>x</sub>+SO<sub>2</sub> first, Primary PM<sub>10</sub>+Primary PM<sub>2.5</sub> second, and CO+NH<sub>3</sub>+VOC last.
3. Selected from the NIF SI table using a plant's STID+CYID+PLANTID or a default of 4911.

**Table 13. CENRAP SMOKE/IDA Winter Season File Structure**

| Position | Name     | Type | Description  | Width | Max Decimals | Blanked         |
|----------|----------|------|--|-------|--------------|-----------------|
| 1-2      | STID     | Int  | State Code   | 2     |              |                 |
| 3-5      | CYID     | Int  | County Code  | 3     |              |                 |
| 6-20     | PLANTID  | Char | Plant Identification Code (default value = "ORIS" + value of ORISID)           | 15    |              |                 |
| 21-35    | POINTID  | Char | Point Identification Code (default value = "#" + value of BLRID)               | 15    |              |                 |
| 36-47    | STACKID  | Char | Stack Identification Code <sup>1</sup>   | 12    |              |                 |
| 48-53    | ORISID   | Char | DOE Plant ID   | 6     |              |                 |
| 54-59    | BLRID    | Char | Boiler Identification Code   | 6     |              |                 |
| 60-61    | SEGMENT  | Char | DOE ID <sup>2</sup>  | 2     |              |                 |
| 62-101   | PLANT    | Char | Plant Name   | 40    |              |                 |
| 102-111  | SCC      | Char | SCC (SCC used in IPM to calculate emissions)                                   | 10    |              | If summed units |
| 112-115  | BEGYR    | Int  | Beginning Year of Unit Operation   | 4     |              | Y               |
| 116-119  | ENDYR    | Int  | Ending Year of Unit Operation  | 4     |              | Y               |
| 120-123  | STKHGT   | Real | Stack Height (ft)  | 4     | 3            |                 |
| 124-129  | STKDIAM  | Real | Stack Diameter (ft)  | 6     | 5            |                 |
| 130-133  | STKTEMP  | Real | Stack Gas Exit Temperature (1F)  | 4     | 3            |                 |
| 134-143  | STKFLOW  | Real | Stack Gas Flow Rate (ft <sup>3</sup> /s)                                       | 10    | 9            |                 |
| 144-152  | STKVEL   | Real | Stack Gas Exit Velocity (ft/s)   | 9     | 8            |                 |
| 153-160  | BOILCAP  | Real | Design Capacity (MMBtu/hr)   | 8     | 0            | Y               |
| 161-161  | CAPUNITS | Char | Capacity Unit Code   | 1     |              | Y               |
| 162-163  | WINTHRU  | Real | Winter throughput (% of Annual)  | 2     | 0            | Y               |
| 164-165  | SPRTHRU  | Real | Spring throughput (% of Annual)  | 2     | 0            | Y               |
| 166-167  | SUMTHRU  | Real | Summer throughput (% of Annual)  | 2     | 0            | Y               |
| 168-169  | FALTHRU  | Real | Fall throughput (% of Annual)  | 2     | 0            | Y               |
| 170-171  | HOURS    | Int  | Normal Operating Time (hr/day)   | 2     |              | Y               |
| 172-173  | START    | Int  | Normal Operation Start Time  | 2     |              | Y               |
| 174-174  | DAYS     | Int  | Normal Operating Time (days/wk)  | 1     |              | Y               |
| 175-176  | WEEKS    | Int  | Normal Operating Time (wk/yr)  | 2     |              | Y               |
| 177-187  | THRUPUT  | Real | Throughput Rate (SCC units/yr)   | 11    | 0            | Y               |
| 188-199  | MAXRATE  | Real | Maximum O <sub>3</sub> Season Rate (units/day)                                 | 12    | 0            | Y               |
| 200-207  | HEATCON  | Real | Heat Content (MMBtu/SCC unit)  | 8     | 0            | Y               |
| 208-212  | SULFCON  | Real | Sulfur Content (mass percent)  | 5     | 0            | Y               |
| 213-217  | ASHCON   | Real | Ash Content (mass percent)   | 5     | 0            | Y               |
| 218-226  | NETDC    | Real | Maximum Nameplate Capacity (MW)  | 9     | 0            | Y               |
| 227-230  | SIC      | Int  | Standard Industrial Classification Code (SIC) <sup>3</sup>                     | 4     |              |                 |
| 231-239  | LATC     | Real | Latitude (decimal degrees)   | 9     | 4            |                 |
| 240-248  | LONC     | Real | Longitude (decimal degrees)  | 9     | 4            |                 |
| 249-249  | OFFSHORE | Char | Offshore Flag  | 1     |              | Y               |
| 250-262  | WINCO    | Real | CO Winter Season Emissions (short tons/season)                                 | 13    | 12           |                 |
| 263-275  | AVDCO    | Real | CO Average Winter Day Emissions (short tons/average season day) (zero per EPA) | 13    | 0            | Y               |
| 276-282  | CE1      | Real | CO Control Efficiency  | 7     | 0            | Y               |
| 283-285  | RE1      | Real | CO Rule Effectiveness  | 3     | 0            | Y               |
| 286-295  | EMF1     | Real | CO Emission Factors (SCC units)  | 10    | 0            | Y               |
| 296-298  | CPRI1    | Int  | CO Primary Control Equipment Code  | 3     |              | Y               |
| 299-301  | CSEC1    | Int  | CO Secondary Control Equipment Code  | 3     |              | Y               |

**Table 13 (continued)**

| Position | Name    | Type | Description   | Width | Max Decimals | Blanked |
|----------|---------|------|---|-------|--------------|---------|
| 302-314  | WINNH3  | Real | NH <sub>3</sub> Winter Season Emissions (short tons/season)   | 13    | 12           |         |
| 315-327  | AVDNH3  | Real | NH <sub>3</sub> Average Winter Day Emissions (short tons/average season day) (zero per EPA)           | 13    | 0            | Y       |
| 328-334  | CE2     | Real | NH <sub>3</sub> Control Efficiency  | 7     | 0            | Y       |
| 335-337  | RE2     | Real | NH <sub>3</sub> Rule Effectiveness  | 3     | 0            | Y       |
| 338-347  | EMF2    | Real | NH <sub>3</sub> Emission Factors (SCC units)  | 10    | 0            | Y       |
| 348-350  | CPRI2   | Int  | NH <sub>3</sub> Primary Control Equipment Code  | 3     |              | Y       |
| 351-353  | CSEC2   | Int  | NH <sub>3</sub> Secondary Control Equipment Code  | 3     |              | Y       |
| 354-366  | WINNOX  | Real | NO <sub>x</sub> Winter Season Emissions (short tons/season)   | 13    | 12           |         |
| 367-379  | AVDNOX  | Real | NO <sub>x</sub> Average Winter Day Emissions (short tons/average season day) (zero per EPA)           | 13    | 0            | Y       |
| 380-386  | CE3     | Real | NO <sub>x</sub> Control Efficiency  | 7     | 0            | Y       |
| 387-389  | RE3     | Real | NO <sub>x</sub> Rule Effectiveness  | 3     | 0            | Y       |
| 390-399  | EMF3    | Real | NO <sub>x</sub> Emission Factors (SCC units)  | 10    | 0            | Y       |
| 400-402  | CPRI3   | Int  | NO <sub>x</sub> Primary Control Equipment Code  | 3     |              | Y       |
| 403-405  | CSEC3   | Int  | NO <sub>x</sub> Secondary Control Equipment Code  | 3     |              | Y       |
| 406-418  | WINPM10 | Real | Primary PM <sub>10</sub> Winter Season Emissions (short tons/season)                                  | 13    | 12           |         |
| 419-431  | AVDPM10 | Real | Primary PM <sub>10</sub> Average Winter Day Emissions (short tons/average season day) (zero per EPA)  | 13    | 0            | Y       |
| 432-438  | CE4     | Real | Primary PM <sub>10</sub> Control Efficiency   | 7     | 0            | Y       |
| 439-441  | RE4     | Real | Primary PM <sub>10</sub> Rule Effectiveness   | 3     | 0            | Y       |
| 442-451  | EMF4    | Real | Primary PM <sub>10</sub> Emission Factors (SCC units)   | 10    | 0            | Y       |
| 452-454  | CPRI4   | Int  | Primary PM <sub>10</sub> Primary Control Equipment Code   | 3     |              | Y       |
| 455-457  | CSEC4   | Int  | Primary PM <sub>10</sub> Secondary Control Equipment Code   | 3     |              | Y       |
| 458-470  | WINPM25 | Real | Primary PM <sub>2.5</sub> Winter Season Emissions (short tons/season)                                 | 13    | 12           |         |
| 471-483  | AVDPM25 | Real | Primary PM <sub>2.5</sub> Average Winter Day Emissions (short tons/average season day) (zero per EPA) | 13    | 0            | Y       |
| 484-490  | CE5     | Real | Primary PM <sub>2.5</sub> Control Efficiency  | 7     | 0            | Y       |
| 491-493  | RE5     | Real | Primary PM <sub>2.5</sub> Rule Effectiveness  | 3     | 0            | Y       |
| 494-503  | EMF5    | Real | Primary PM <sub>2.5</sub> Emission Factors (SCC units)  | 10    | 0            | Y       |
| 504-506  | CPRI5   | Int  | Primary PM <sub>2.5</sub> Primary Control Equipment Code  | 3     |              | Y       |
| 507-509  | CSEC5   | Int  | Primary PM <sub>2.5</sub> Secondary Control Equipment Code  | 3     |              | Y       |
| 510-522  | WINSO2  | Real | SO <sub>2</sub> Winter Season Emissions (short tons/season)   | 13    | 12           |         |
| 523-535  | AVDSO2  | Real | SO <sub>2</sub> Average Winter Day Emissions (short tons/average season day) (zero per EPA)           | 13    | 0            | Y       |
| 536-542  | CE6     | Real | SO <sub>2</sub> Control Efficiency  | 7     | 0            | Y       |
| 543-545  | RE6     | Real | SO <sub>2</sub> Rule Effectiveness  | 3     | 0            | Y       |
| 546-555  | EMF6    | Real | SO <sub>2</sub> Emission Factors (SCC units)  | 10    | 0            | Y       |
| 556-558  | CPRI6   | Int  | SO <sub>2</sub> Primary Control Equipment Code  | 3     |              | Y       |
| 559-561  | CSEC6   | Int  | SO <sub>2</sub> Secondary Control Equipment Code  | 3     |              | Y       |

**Table 13 (continued)**

| Position | Name   | Type | Description   | Width | Max Decimals | Blanked |
|----------|--------|------|---|-------|--------------|---------|
| 562-574  | WINVOC | Real | VOC Winter Season Emissions (short tons/season)                                 | 13    | 12           |         |
| 575-587  | AVDVOC | Real | VOC Average Winter Day Emissions (short tons/average season day) (zero per EPA) | 13    | 0            | Y       |
| 588-594  | CE7    | Real | VOC Control Efficiency  | 7     | 0            | Y       |
| 595-597  | RE7    | Real | VOC Rule Effectiveness  | 3     | 0            | Y       |
| 598-607  | EMF7   | Real | VOC Emission Factors (SCC units)  | 10    | 0            | Y       |
| 608-610  | CPRI7  | Int  | VOC Primary Control Equipment Code  | 3     |              | Y       |
| 611-613  | CSEC7  | Int  | VOC Secondary Control Equipment Code  | 3     |              | Y       |

1. Selected from the NIF EM table using corresponding segment ID from using the segment ID selection process. Defaults taken from IPM process and are either from EPA approved files or are Pechan defaults (41, 42, 43, etc).
2. Segment ID selection process used to determine which ID is used. Process consists of taken the segment ID from the NIF EM table with the highest emissions. Only the seven relevant pollutants are used and follow a hierarchy of NO<sub>x</sub>+SO<sub>2</sub> first, Primary PM<sub>10</sub>+Primary PM<sub>2.5</sub> second, and CO+NH<sub>3</sub>+VOC last.
3. Selected from the NIF SI table using a plant's STID+CYID+PLANTID or a default of 4911.

**Table 14. Summary of Summer Season, Summer Day, and Winter Season Emissions for 2018 EGU Inventory**

| State FIPS                  | State Name | CO     | NH <sub>3</sub> | NO <sub>x</sub> | PM10-PRI | PM25-PRI | SO <sub>2</sub> | VOC   |
|-----------------------------|------------|--------|-----------------|-----------------|----------|----------|-----------------|-------|
| <b>Summer Season (Tons)</b> |            |        |                 |                 |          |          |                 |       |
| 5                           | Arkansas   | 5,052  | 359             | 14,836          | 1,725    | 1,472    | 36,566          | 309   |
| 19                          | Iowa       | 3,776  | 244             | 22,252          | 4,370    | 3,757    | 64,384          | 335   |
| 20                          | Kansas     | 3,484  | 227             | 37,207          | 3,795    | 3,037    | 36,070          | 361   |
| 22                          | Louisiana  | 5,396  | 438             | 14,240          | 1,798    | 1,631    | 32,873          | 313   |
| 27                          | Minnesota  | 2,648  | 166             | 17,940          | 3,562    | 3,086    | 36,647          | 302   |
| 29                          | Missouri   | 6,289  | 392             | 34,350          | 8,182    | 7,440    | 123,128         | 707   |
| 31                          | Nebraska   | 1,622  | 98              | 22,524          | 1,019    | 850      | 32,592          | 200   |
| 40                          | Oklahoma   | 13,611 | 664             | 36,695          | 2,559    | 2,240    | 50,321          | 500   |
| 48                          | Texas      | 56,832 | 3,574           | 79,449          | 18,154   | 14,916   | 150,220         | 2,661 |
|                             | Totals     | 98,710 | 6,163           | 279,493         | 45,164   | 38,430   | 562,802         | 5,688 |
| <b>Winter Season (Tons)</b> |            |        |                 |                 |          |          |                 |       |
| 5                           | Arkansas   | 6,377  | 456             | 18,261          | 2,172    | 1,854    | 46,039          | 387   |
| 19                          | Iowa       | 4,982  | 324             | 28,867          | 5,663    | 4,859    | 82,921          | 435   |
| 20                          | Kansas     | 3,719  | 234             | 46,126          | 4,725    | 3,770    | 45,416          | 437   |
| 22                          | Louisiana  | 5,648  | 481             | 16,192          | 2,169    | 1,958    | 41,390          | 347   |
| 27                          | Minnesota  | 2,916  | 176             | 23,089          | 4,599    | 3,948    | 49,200          | 372   |
| 29                          | Missouri   | 6,876  | 407             | 43,310          | 10,274   | 9,330    | 157,759         | 871   |
| 31                          | Nebraska   | 1,968  | 118             | 28,256          | 1,277    | 1,064    | 41,037          | 250   |
| 40                          | Oklahoma   | 14,571 | 691             | 39,353          | 3,001    | 2,600    | 63,359          | 508   |
| 48                          | Texas      | 45,750 | 2,849           | 74,388          | 20,798   | 16,714   | 189,213         | 2,326 |
|                             | Totals     | 92,807 | 5,738           | 317,843         | 54,678   | 46,098   | 716,333         | 5,935 |
| <b>Summer Day (Tons)</b>    |            |        |                 |                 |          |          |                 |       |
| 5                           | Arkansas   | 36     | 3               | 107             | 12       | 11       | 262             | 2     |
| 19                          | Iowa       | 37     | 3               | 167             | 33       | 28       | 472             | 3     |
| 20                          | Kansas     | 27     | 2               | 268             | 27       | 22       | 257             | 3     |
| 22                          | Louisiana  | 38     | 3               | 93              | 13       | 11       | 235             | 2     |
| 27                          | Minnesota  | 20     | 1               | 128             | 25       | 22       | 259             | 2     |
| 29                          | Missouri   | 51     | 3               | 249             | 59       | 53       | 874             | 5     |
| 31                          | Nebraska   | 12     | 1               | 166             | 8        | 6        | 240             | 1     |
| 40                          | Oklahoma   | 100    | 5               | 264             | 18       | 16       | 353             | 4     |
| 48                          | Texas      | 409    | 26              | 559             | 125      | 103      | 1,034           | 19    |
|                             | Totals     | 731    | 46              | 2,001           | 320      | 273      | 3,987           | 41    |



**F. Preparation of SMOKE/IDA and RPO Data Exchange Protocol (NIF 3.0) Formats**

This section describes the inventory and SMOKE emission processor files prepared under this project. The Excel Workbook file named “CENRAP Inventory File Documentation 08225.xls” provides the names of the files delivered, as well as other file information useful for transferring data to air quality modeling centers. This Excel Workbook file is provided along with this report. Table 15 provides a summary of the files delivered.

**Table 15. Summary of Mass Emissions and SMOKE Input Files**

| S/L/T Agencies Included in Files  | NIF 3.0 File Name Containing Mass Emissions Inventory (Access 2000 Database Files) | Temporal Period of Mass Emissions Inventory | SMOKE/IDA File Name   | Temporal Period of Emissions in SMOKE/IDA File | Notes   |
|---|--|---|---|--|---|
| <b>Point Source Inventory for 2002</b>  |  |   |   |  |   |
| AR, IA, KS, LA, MN, MO, NE, OK, TX, Fond du Lac Band of the Minnesota Chippewa Tribe (Tribal Code 405), and the Leech Lake Band of the Ojibwe Tribe (407) | CENRAP_2002_Point_082205.mdb   | Annual                                      | CENRAP_POINT_SMOKE_INPUT_ANNUAL_DAILY_072505.txt                    | Annual for all agencies; Daily for MO and TX   | Includes all sectors supplied by S/L/T agencies. Tribal inventories include Fond du Lac Band of the Minnesota Chippewa and the Leech Lake Band of the Ojibwe. Local inventories include Lancaster County (Lincoln) and Douglas County (Omaha), NE.  |
| MO and TX   | CENRAP_2002_Point_Daily_Missouri_Texas_071405.mdb                                  | Daily                                       | CENRAP_POINT_SMOKE_INPUT_ANNUAL_DAILY_072505.txt                    | "  | Daily emissions for MO and TX are included in the SMOKE/IDA file containing annual emissions for all CENRAP agencies, but placed in a NIF 3.0 file separate from the NIF 3.0 file containing the annual emissions.  |
| <b>Point Source Inventory for 2108</b>  |  |   |   |  |   |
| AR, IA, KS, LA, MN, MO, NE, OK, TX  | None   |   | CENRAP_2018_Summer_081105.txt,<br><br>CENRAP_2018_Winter_081105.txt | Summer season,<br><br>Winter season            | 2018 EGU summer season and winter season emissions.   |
| <b>Nonroad Source Inventory for 2002</b>  |  |   |   |  |   |
| AR, IA, KS, LA, MN, MO, NE, OK, TX  | CENRAP_2002_Nonroad_071305.mdb   | Annual, Monthly, and Daily                  | CENRAP_NONROAD_SMOKE_INPUT_ANN_071305.txt                           | Annual   | Includes NONROAD Model Categories and Aircraft, Commercial Marine Vessels, and Railroad Locomotives. NONROAD Model inventory is from revised CENRAP-sponsored inventory except for TX (who supplied its own NONROAD Model Inventory), MN (who used the Midwest RPO Base J inventory for all NONROAD Model categories), and IA (who used the Midwest RPO Base J inventory for agricultural equipment). MN included commercial and military aircraft and auxiliary power units in its point source inventory; therefore, the nonroad inventory does not contain emissions for these categories in MN. |
| MN and IA   | "  | "   | CENRAP_NONROAD_SMOKE_INPUT_MONTH_JAN_071305.txt                     | Monthly Emissions x 12                         | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months).   |
| <b>Nonroad Source Inventory for 2002 (continued)</b>  |  |   |   |  |   |

**Table 15 (continued)**

| <b>S/L/T Agencies Included in Files</b>              | <b>NIF 3.0 File Name Containing Mass Emissions Inventory (Access 2000 Database Files)</b> | <b>Temporal Period of Mass Emissions Inventory</b> | <b>SMOKE/IDA File Name</b>                      | <b>Temporal Period of Emissions in SMOKE/IDA File</b> | <b>Notes</b>  |
|--|---|--|---|---|---|
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_FEB_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_MAR_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_APR_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_MAY_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_JUN_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_JUL_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_AUG_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| MN and IA  | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_SEP_071305.txt | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months). |
| <b>Nonroad Source Inventory for 2002 (continued)</b> |   |  |   |   |   |

**Table 15 (continued)**

| <b>S/L/T Agencies Included in Files</b> | <b>NIF 3.0 File Name Containing Mass Emissions Inventory (Access 2000 Database Files)</b> | <b>Temporal Period of Mass Emissions Inventory</b> | <b>SMOKE/IDA File Name</b>                       | <b>Temporal Period of Emissions in SMOKE/IDA File</b> | <b>Notes</b>   |
|---|---|--|--|---|--|
| MN and IA                               | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_OCT_071305.txt  | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months).  |
| MN and IA                               | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_NOV_071305.txt  | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months).  |
| MN and IA                               | "   | "  | CENRAP_NONROAD_SMOKE_INPUT_MONTH_DEC_071305.txt  | Monthly Emissions x 12                                | Includes monthly emissions for MN (all NONROAD Model categories) and IA (agricultural equipment categories) from the Midwest RPO Base J inventory. Monthly emissions are multiplied by 12 (months).  |
| <b>Area Source Inventory for 2002</b>   |   |  |  |   |  |
| AR, IA, KS, LA, MN, MO, NE, OK, TX      | CENRAP_2002_Area_082205.mdb   | Annual, Daily, and Monthly                         | CENRAP_AREA_SMOKE_INPUT_ANN_STATE_081705.txt     | Annual  | Includes all sectors except for those included in the Area Misc files. Planned burning emissions from CENRAP-sponsored area source inventory are excluded for AR, IA, KS, LA, MN, MO, OK, and NE (except for Lancaster County [FIPS 31109]); the SMOKE files for the CENRAP planned burning inventory will be used for these states. |
| AR, IA, KS, LA, MN, MO, NE, OK          | "   | "  | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_JAN_071905.txt | Monthly Emissions x 12                                | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).   |
| AR, IA, KS, LA, MN, MO, NE, OK          | "   | "  | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_FEB_071905.txt | Monthly Emissions x 12                                | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).   |
| AR, IA, KS, LA, MN, MO, NE, OK          | "   | "  | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_MAR_071905.txt | Monthly Emissions x 12                                | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).   |

**Table 15 (continued)**

| S/L/T Agencies Included in Files                  | NIF 3.0 File Name Containing Mass Emissions Inventory (Access 2000 Database Files) | Temporal Period of Mass Emissions Inventory | SMOKE/IDA File Name                                    | Temporal Period of Emissions in SMOKE/IDA File | Notes   |
|---|--|---|--|--|---|
| <b>Area Source Inventory for 2002 (continued)</b> |  |   |  |  |   |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_APR_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_MAY_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_JUN_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_JUL_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_AUG_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_SEP_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_OCT_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_NOV_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| AR, IA, KS, LA, MN, MO, NE, OK                    | "  | "   | CENRAP_AREA_SMOKE_INPUT_NH3_MONTH_DEC_071905.txt       | Monthly Emissions x 12                         | All sectors except for those included in the Area Misc files. Monthly emissions are multiplied by 12 (months).  |
| TX and Lancaster County, NE                       | "  | "   | CENRAP_AREA_BURNING_SMOKE_INPUT_ANN_TX_NELI_071905.txt | Annual   | Includes state and local prepared planned burning emissions. SMOKE input files for area source planned burning emissions for all other states are available from CENRAP-sponsored inventory.  |
| Fond du Lac Band of the Minnesota Chippewa Tribe  | CENRAP Area Tribal Inventories_082205.mdb  | Annual                                      | CENRAP_AREA_SMOKE_INPUT_ANN_TRIBE_120704.txt           | Annual   | The NIF file includes the data provided by both tribes. The SMOKE file Includes emissions for the paved and unpaved road and prescribed burning area source categories provided by the Fond du Lac Tribe. The SMOKE file was not revised to add the data provided by the Leech Lake Tribe since SMOKE is not programmed to process tribal area source inventory data. |

**Table 15 (continued)**

| S/L/T Agencies Included in Files                    | NIF 3.0 File Name Containing Mass Emissions Inventory (Access 2000 Database Files) | Temporal Period of Mass Emissions Inventory | SMOKE/IDA File Name                                       | Temporal Period of Emissions in SMOKE/IDA File | Notes  |
|---|--|---|---|--|--|
| <b>Area Miscellaneous Source Inventory for 2002</b> |  |   |   |  |  |
| AR, IA, KS, LA, MN, MO, NE, OK, TX                  | CENRAP_2002_Area_Misc_082205.mdb   | Annual, Daily, and Monthly                  | CENRAP_AREA_MISC_SMOKE_INPUT_ANN_ST<br>ATE_071905.txt     | Annual   | NH <sub>3</sub> emissions from natural sources for all states, and PM10-PRI and PM25-PRI emissions for geogenic wind erosion for AR. |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH JAN_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH FEB_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH MAR_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH APR_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH MAY_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH JUN_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH JUL_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH AUG_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH SEP_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH OCT_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH NOV_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |
| IA, KS, LA, MN, MO, NE, OK                          | "  | "   | CENRAP_AREA_MISC_SMOKE_INPUT_NH3_M<br>ONTH DEC_072805.txt | Monthly Emissions x 12                         | NH <sub>3</sub> emissions from natural sources. Monthly emissions are multiplied by 12 (months).                                     |

### III. SUMMARIES OF EMISSIONS INVENTORIES FOR THE CENRAP REGION

Summaries of emissions were prepared from the emission inventory files for each sector and for all sectors combined. The summaries are provided in an Access 2000 database named “CENRAP Base B Emission Summaries\_082205.mdb”. The same summaries are also provided in an Access 97 database named “CENRAP Base B Emission Summaries\_082205\_Acc97.mdb”.

Table 16 identifies and briefly describes the contents of the emissions summary tables included in the database. The nonroad source sector summaries include emissions for aircraft, commercial marine vessels, and locomotives as well as the emissions from the NONROAD model categories. The onroad summaries were prepared from the revised CENRAP-sponsored inventory for onroad sources. Tables 1G, 2C, 3C, 4C, and 5C include the data source code for the area, point, nonroad, and onroad sectors to assist in identifying the origin and year of emissions inventory data. The data source codes were defined previously in Chapter II of this report.

The summaries in Appendix A of this report are taken from the emissions summary Table 1D. These summaries include natural sources NH<sub>3</sub> emissions and the biogenic wind erosion PM<sub>10</sub>-PRI and PM<sub>25</sub>-PRI emissions; thus, the emission totals in Appendix A match the totals in Chapter I, Table 1 of this report. Note, however, that the emissions for natural sources and wind erosion are excluded from Tables 2a through 2e of Chapter I.

A second Access 2000 database named “CENRAP Emission Summaries\_Compare Base B to A\_082205.mdb” provides summaries that compare the emissions in the Base B inventory to the Base A inventory. These summaries are provided for the “All Sector” Tables 1A through 1F series of summaries. These summaries are useful for identifying the states and sectors where annual emissions changed significantly as a result of the comments received on the Base A inventories for all of the sectors. This database is also provided in Access 97 format (named “CENRAP Emission Summaries\_Compare Base B to A\_082205\_Acc97.mdb”).

**Table 16. Emissions Summaries**

| Summary Table Name          | Description  |
|-----------------------------|--|
| <b>All Sector Summaries</b> |  |
| Table 1A_All Sectors        | Summary of Annual Emissions by Pollutant and Sector for the CENRAP Region  |
| Table 1B_All Sectors        | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name/Pollutant and Sector                                  |
| Table 1C_All Sectors        | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name/County FIPS/County Name/Pollutant and Sector          |
| Table 1D_All Sectors        | Summary of Annual Emissions by Category/Sector and Pollutant for the CENRAP Region   |
| Table 1E_All Sectors        | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name/ Source Category Name and Number/Sector and Pollutant |

**Table 16 (continued)**

| <b>Summary Table Name</b>                                       | <b>Description</b>  |
|---|---|
| <b>Area Source and Biogenic/Natural Source Sector Summaries</b> |   |
| Table 1F_All Sectors  | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name/County FIPS/County Name/Source Category Name and Number/Sector and Pollutant   |
| Table 1G_All Sectors  | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name/County FIPS/County Name/SCC and SCC Description/Source Category Name and Number/ Sector/Pollutant and Data Source Code |
| Table 2A_Area Sources   | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name and Pollutant  |
| Table 2B_Area Sources   | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name/County FIPS/County Name and Pollutant  |
| Table 2C_Area Sources   | Summary of Annual Emissions and Data Source Codes by State FIPS/Tribal Code/State Name/Tribal Name/County FIPS/County Name/SCC/SCC Description and Pollutant  |
| Table 2D_Area Sources   | Summary of Annual Emissions by SCC/SCC Description/Pollutant and State/Tribe  |
| Table 2E_Area Sources   | Summary of Annual Emissions by Pollutant and State/Tribe  |
| <b>Point Source Sector Summaries</b>                            |   |
| Table 3A_Point Sources  | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name and Pollutant  |
| Table 3B_Point Sources  | Summary of Annual Emissions by State FIPS/Tribal Code/State Name/Tribal Name/County FIPS/County Name and Pollutant  |
| Table 3C_Point Sources  | Summary of Annual Emissions and Data Source Codes by State FIPS/Tribal Code/State Name/Tribal Name/County FIPS/County Name/SCC/SCC Description and Pollutant  |
| Table 3D_Point Sources  | Summary of Annual Emissions by SCC/SCC Description/Pollutant and State/Tribe  |
| Table 3E_Point Sources  | Summary of Annual Emissions by Pollutant and State/Tribe  |
| Table 3F_Point Sources  | Facility-level Summary  |
| <b>Nonroad Source Sector Summaries</b>                          |   |
| Table 4A_Nonroad Sources  | Summary of Annual Emissions by State FIPS/State Name and Pollutant  |
| Table 4B_Nonroad Sources  | Summary of Annual Emissions by State FIPS/State Name/County FIPS/County Name and Pollutant  |
| Table 4C_Nonroad Sources  | Summary of Annual Emissions and Data Source Codes by State FIPS/State Name/County FIPS/County Name/SCC/SCC Description and Pollutant  |
| Table 4D_Nonroad Sources  | Summary of Annual Emissions by SCC/SCC Description/Pollutant and State  |
| Table 4E_Nonroad Sources  | Summary of Annual Emissions by Pollutant and State  |
| <b>Onroad Source Sector Summaries</b>                           |   |
| Table 5A_Onroad Sources   | Summary of Annual Emissions by State FIPS/State Name and Pollutant  |
| Table 5B_Onroad Sources   | Summary of Annual Emissions by State FIPS/State Name/County FIPS/County Name and Pollutant  |
| Table 5C_Onroad Sources   | Summary of Annual Emissions and Data Source Codes by State FIPS/State Name/County FIPS/County Name/SCC/SCC Description and Pollutant  |
| Table 5D_Onroad Sources   | Summary of Annual Emissions by SCC/SCC Description/Pollutant and State  |
| Table 5E_Onroad Sources   | Summary of Annual Emissions by Pollutant and State  |



## **IV. METHODS FOR AREAS OUTSIDE OF THE CENRAP REGION**

### **A. Data Sources and Augmentation Procedures**

This task involved calculating fire emissions and source parameters given fuel, location, and time period information for the Province of Ontario, Canada. CENRAP made the “raw” data for these fires available at [http://www.cenrap.org/emission\\_document.asp](http://www.cenrap.org/emission_document.asp). The names of the specific files made available include the following:

“Ontario Fires over 100 ha 1992- 2002 WFR.xls”

“Ontario Fires over 100 ha 1992 -2002 WFR-EXPLAIN.xls”

The files contain data for 54 fires that occurred in Ontario during the year 2002. Information on the data code abbreviations, data definitions, and data units used in the raw data files was obtained from Mr. Rob Luik (Data Management Specialist) at the Ontario Ministry of Natural Resources ([Rob.Luik@MNR.gov.on.ca](mailto:Rob.Luik@MNR.gov.on.ca)). Tables 17 and 18 provide definitions of the fuel types and other data provided in the raw data files.

### **B. Development of BlueSky Inputs**

Emissions for each fire were estimated using the Emission Production Model (EPM)/CONSUME within the BlueSky framework. To run EPM/CONSUME, the following information was needed for each fire:

- Fire identification code;
- Latitude and longitude of the fire;
- Start and end dates of the fire;
- Daily size of the fire; and
- Fuel loading information.

A fire identification code is needed to track individual fires throughout the processing. The unique fire identification code was created for each fire by concatenating the FIRE\_NUMBER and CUR\_DIST fields of the original data. The fire identification code also contains the FIPS code of the fire; this information is not used by BlueSky but is needed by BlueSky2Inv, the utility program that converts the BlueSky output to the SMOKE inventory format. The FIPS code 135000 was used for all fires with longitudes east of  $-90^{\circ}$ , and FIPS code 135059 was used for fires west of  $-90^{\circ}$ . These FIPS codes were used to ensure that the fires would be assigned the correct time zones in later SMOKE processing.

The DISC\_DATE field (discovery date) was used as the start date for each fire. While the original data did provide start dates earlier than the discovery date for some fires, the discovery date was used for all fires for consistency. Similarly, the OUT\_DATE field was used from the original data as the end date for each fire. Some of the dates provided in the original data included hourly information. In all cases, the hourly information was not used leaving all data at a daily resolution.

**Table 17. Fuel Type Definitions Provided by the Ontario Ministry of Natural Resources**

| <b>FUEL_TYPE</b> | <b>CODEDESC</b>   |
|------------------|---|
| C1               | C1 Spruce Lichen Woodland                               |
| C2               | C2 Boreal Spruce  |
| C3               | C3 Mature Jack Pine                                     |
| C4               | C4 Immature Jackpine                                    |
| C5               | C5 Red and White Pine                                   |
| C6               | C6 Conifer Plantation                                   |
| M125             | M1 Boreal Mixedwood Leafless 25% Conifer                |
| M150             | M1 Boreal Mixedwood Leafless 50% Conifer                |
| M175             | M1 Boreal Mixedwood Leafless 75% Conifer                |
| M225             | M2 Boreal Mixedwood Green 25% Conifer                   |
| M250             | M2 Boreal Mixedwood Green 50% Conifer                   |
| M275             | M2 Boreal Mixedwood Green 75% Conifer                   |
| M325             | M3 Dead Balsam Fir/Mixed Wood Leafless 30% Dead Balsam  |
| M350             | M3 Dead Balsam Fir/Mixed Wood Leafless 60% Dead Balsam  |
| M375             | M3 Dead Balsam Fir/Mixed Wood Leafless 100% Dead Balsam |
| M425             | M4 Dead Balsam Fir/Mixedwood Green 30% Dead Balsam      |
| M450             | M4 Dead Balsam Fir/Mixedwood Green 60% Dead Balsam      |
| M475             | M4 Dead Balsam Fir/Mixedwood Green 100% Dead Balsam     |
| O1A100           | O1a Matted Grass 100% cured                             |
| O1A50            | O1a Matted Grass 50% cured                              |
| O1A75            | O1a Matted Grass 75% cured                              |
| O1B100           | O1b Standing Grass 100% cured                           |
| O1B50            | O1b Standing Grass 50% cured                            |
| O1B75            | O1b Standing Grass 75% cured                            |
| S1               | S1 Jackpine Slash                                       |
| S2               | S2 White Spruce Balsam Slash                            |
| S3               | S3 Coastal Cedar/Hemlock/Douglas-fir slash              |
| GRA              | Grass   |
| SLA              | Slash   |
| SHR              | Shrubs, Hwd Brush                                       |
| CON              | Conifer   |
| IKC              | Insect Killed Conifer                                   |
| MIX              | Mixed Wood  |
| HAR              | Hard Wood   |
| BLO              | Blowdown  |
| PLA              | Plantation  |
| OTH              | Other   |

**Table 18. Other Data Definitions Provided by the Ontario Ministry of Natural Resources**

|              |                      |
|--------------|----------------------|
| START_DATE   | Start Date           |
| DISC_DATE    | Discovered date      |
| F_REP_DATE   | First Reported date  |
| S_REP_DATE   | Second Reported date |
| GETAWAY_DATE | Getaway date         |
| ATTACK_DATE  | Attack date          |
| BHE_DATE     | Being Held date      |
| UCO_DATE     | Under Control date   |
| OUT_DATE     | Out date             |

The total number of days each fire burned was determined using the start and end date for each fire. For each fire, the size of the area burned each day was estimated. The original data included the final size of each fire which was used to determine the total area burned by each fire. Rather than introduce additional assumptions about the daily fire size, it was assumed that the area burned each day was constant over all days. Therefore, the total size of the fire was divided by the total days the fire burned to get an estimate of the daily fire size. The area burned by each fire was converted from hectares to acres as needed by EPM/CONSUME.

For each fire, fuel loading data must be provided to indicate the type of fuels available for burning so that the emissions can be estimated. The original data included fuel type information for each fire using the Canadian Forest Fire Danger Rating System (CFFDRS) fuel types. Descriptions of each fuel type are available at [http://fire.cfs.nrcan.gc.ca/research/environment/cffdrs/fbpfuels\\_e.htm](http://fire.cfs.nrcan.gc.ca/research/environment/cffdrs/fbpfuels_e.htm). Detailed fuel information for these types could not be identified; therefore, the CFFDRS types were mapped to the types used by the National Fire Danger Rating System (NFDRS). Information about these fuel types is available at <http://www.fs.fed.us/fire/planning/nist/nfdr.htm>. Table 19 shows how the CFFDRS fuel types in the original data were mapped to the NFDRS fuel types, and shows the total number of fires for each fuel type. Table 20 shows the default fuel loading factors included in BlueSky for each NFDRS fuel type.

**Table 19. Mapping of Canadian to National Fire Danger Rating System Fuel Types**

| Canadian Forest Fire Danger Rating System | National Fire Danger Rating System          | Number of Fires |
|---|---|-----------------|
| C2: Boreal Spruce                         | Q: Dense Alaskan black spruce and shrubs    | 36              |
| C3: Mature Jack Pine                      | C: Open pine perennial grass understory     | 4               |
| C4: Immature Jack Pine                    | G: Dense conifer with heavy downed and duff | 1               |
| C6: Conifer Plantation                    | U: Closed western long-neededled pines      | 4               |
| M2: Boreal Mixedwood – Green              | R: Hardwoods after leafout                  | 2               |
| M3: Dead Balsam Fir Mixedwood – Leafless  | G: Dense conifer with heavy downed and duff | 1               |
| M4: Dead Balsam Fir Mixedwood - Green     | G: Dense conifer with heavy downed and duff | 1               |

**Table 20. Default Fuel Loading Factors Associated with National Fire Danger Rating System Fuel Types**

| <b>Type</b>      | <b>Tons/Acre of Fuel by Fuel Size in Inches</b> |                 |              |              |               |            |
|------------------|---|-----------------|--------------|--------------|---------------|------------|
|                  | <i>0 – 0.25</i>                                 | <i>0.25 – 1</i> | <i>1 – 3</i> | <i>3 – 9</i> | <i>9 – 20</i> | <i>20+</i> |
| C: Open pine     | 1.0   | 2.2             | 0.0          | 0.0          | 0.0           | 0.0        |
| G: Dense conifer | 2.9   | 2.3             | 5.6          | 13.2         | 0.0           | 0.0        |
| Q: Dense spruce  | 3.0   | 3.5             | 3.0          | 1.0          | 0.0           | 0.0        |
| R: Hardwoods     | 0.6   | 0.6             | 0.6          | 0.0          | 0.0           | 0.0        |
| U: Closed pines  | 1.5   | 1.5             | 1.0          | 0.0          | 0.0           | 0.0        |

Three of the 54 fires in the raw data files did not have any latitude and longitude coordinates or any fuel type data. Therefore, the three fires were excluded from the inventory. The three fires combined accounted for less than 1 percent of the total area burned by all 54 fires. The raw data files did not contain any fuel type data for two other fires. The coordinates provided for these two fires were matched with the BELD3 database to determine the dominant vegetation type at the location of each fire. In both cases, the vegetation type was USGS conifer, which was mapped to NFDRS Type U (closed western long-needled pines).

All other inputs to EPM/CONSUME including meteorology-based parameters used the BlueSky defaults.

### **C. Development of SMOKE Inventory Files**

After running BlueSky with the prepared inputs, the SMOKE utility program “BlueSky2Inv” was used to convert the EPM/CONSUME output to the inventory files needed by SMOKE. Since the EPM/CONSUME output is daily, BlueSky2Inv creates a PTHOUR file containing the daily emissions for each fire. The data included in the PTHOUR file are daily values for the fire’s area (AREA), heat flux (HFLUX), PM<sub>2.5</sub>, PMC (calculated as PM<sub>10</sub> – PM<sub>2.5</sub>), CO, and total organic gases (TOG) (calculated as methane + non-methane hydrocarbons).

BlueSky2Inv also creates an annual IDA inventory file. This file does not contain any emissions data but serves as a master list of sources. The annual inventory also contains the latitude and longitude of each fire. For all sources, BlueSky2Inv assigned the SCC 2810001000 (Miscellaneous Area Sources; Other Combustion; Forest Wildfires; Total).

Since BlueSky2Inv was developed for US inventories; therefore, the “#COUNTRY” headers in both output inventories were changed to CANADA.

### **D. SMOKE Input Files**

The draft inventory files were provided to CENRAP via email on July 19, 2005. The following files were delivered:

- ptinv.ontario\_fires.2002.txt: annual fire event inventory in IDA format
- ptday.ontario\_fires.2002.txt: daily fire emissions inventory
- monthly.ontario.2002.txt: a report file summarizes the emissions by fire and by month.  
This report could be used to build monthly or annual fire emissions inventories if needed.

#### **E. Emissions Summary**

Table 21 provides a summary of monthly emissions calculated for 2002 Ontario fires. Emissions were estimated for CO, PM<sub>2.5</sub>, coarse PM (PMC) and TOG. Note that the modeling framework selected for estimating emissions does not include factors for estimating NO<sub>x</sub>, SO<sub>2</sub>, and NH<sub>3</sub>.

**Table 21. Summary of 2002 Ontario Fire Emissions by Month**

| <b>Month</b>  | <b>Number of Fires</b> | <b>Area Burned (Acres)</b> | <b>CO (tons)</b> | <b>PM<sub>2.5</sub> (Tons)</b> | <b>PMC (Tons)</b> | <b>TOG (Tons)</b> |
|---------------|------------------------|----------------------------|------------------|--------------------------------|-------------------|-------------------|
| May           | 2                      | 247                        | 41.5             | 4.3                            | 0.5               | 3.7               |
| June          | 9                      | 13,436                     | 12,368.8         | 1,140.8                        | 118.3             | 743.6             |
| July          | 51                     | 209,954                    | 183,407.5        | 16,807.9                       | 1,734.3           | 10,810.4          |
| August        | 39                     | 170,831                    | 146,623.3        | 13,445.3                       | 1,386.7           | 8,649.9           |
| September     | 10                     | 27,950                     | 23,709.5         | 2,169.1                        | 223.2             | 1,397.8           |
| October       | 1                      | 993                        | 878.3            | 80.0                           | 8.2               | 51.5              |
| <b>Totals</b> |                        | <b>423,411</b>             | <b>367,028.8</b> | <b>33,647.4</b>                | <b>3,471.3</b>    | <b>21,656.8</b>   |

## **V. REFERENCES**

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## **APPENDIX A**

### **SUMMARIES OF ANNUAL EMISSIONS BY SOURCE CATEGORY, SECTOR, AND POLLUTANT**



**Table A-1. Summary of Annual VOC Emissions for the CENRAP Region by Category, Sector, and Pollutant: Base B Inventory**

| Category   | Category Number | Sector  | VOC       |                  |                    |
|--|-----------------|---------|-----------|------------------|--------------------|
|  |                 |         | Tons/Year | Percent of Total | Cumulative Percent |
| Mobile Sources-Highway Vehicles-Gasoline                                   | 2201            | ON-ROAD | 900,621   | 23.69            | 23.69              |
| Industrial Processes-Oil and Gas Production: SIC 13                        | 2310            | AREA    | 413,569   | 10.88            | 34.57              |
| Mobile Sources-Pleasure Craft  | 2282            | NONROAD | 342,086   | 9                | 43.57              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer and Commercial  | 24600 - 24      | AREA    | 165,299   | 4.35             | 47.92              |
| Industrial Surface Coating   | 2401015000      | AREA    | 160,593   | 4.22             | 52.14              |
| Mobile Sources-Off-highway Vehicle Gasoline, 2-Stroke                      | 2260            | NONROAD | 146,802   | 3.86             | 56                 |
| Stationary Source Fuel Combustion-Residential                              | 2104            | AREA    | 144,946   | 3.81             | 59.81              |
| Solvent Utilization-Miscellaneous Non-industrial: Commercial               | 24610 - 24      | AREA    | 126,217   | 3.32             | 63.13              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Field Burning     | 28015           | AREA    | 98,828    | 2.6              | 65.73              |
| Petroleum and Petroleum Product Storage & Transport-Other                  | 250             | AREA    | 96,513    | 2.54             | 68.27              |
| Industrial Processes-Pulp and Paper and Wood Products                      | 307             | POINT   | 95,174    | 2.5              | 70.77              |
| Architectural Coatings   | 2401001000      | AREA    | 82,943    | 2.18             | 72.95              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                      | 2265            | NONROAD | 82,678    | 2.17             | 75.12              |
| Industrial Processes-Chemical Manufacturing                                | 301             | POINT   | 67,995    | 1.79             | 76.91              |
| Industrial Processes-Petroleum Industry                                    | 306             | POINT   | 65,746    | 1.73             | 78.64              |
| Degreasing   | 2415            | AREA    | 63,065    | 1.66             | 80.3               |
| Miscellaneous Area Sources-Other Combustion                                | 2810            | AREA    | 54,195    | 1.43             | 81.73              |
| Petroleum and Solvent Evaporation-Surface Coating Operations               | 402             | POINT   | 49,880    | 1.31             | 83.04              |
| Mobile Sources-Off-highway Vehicle Diesel                                  | 2270            | NONROAD | 45,829    | 1.21             | 84.25              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                 | 2465            | AREA    | 45,538    | 1.2              | 85.45              |
| Gas Marketing Stage I  | 25010600        | AREA    | 41,726    | 1.1              | 86.55              |
| Miscellaneous Area Sources-Other Combustion                                | 2810            | POINT   | 39,592    | 1.04             | 87.59              |
| Open Burning-Waste Disposal, Treatment, and Recovery                       | 261             | AREA    | 33,986    | 0.89             | 88.48              |
| Mobile Sources-Highway Vehicles-Diesel                                     | 2230            | ON-ROAD | 30,083    | 0.79             | 89.27              |
| Petroleum and Solvent Evaporation-Petroleum Product Storage at Refineries  | 403             | POINT   | 27,726    | 0.73             | 90                 |
| Industrial Processes-Oil and Gas Production                                | 310             | POINT   | 25,924    | 0.68             | 90.68              |
| Internal Combustion Engines-Industrial                                     | 2020            | POINT   | 25,559    | 0.67             | 91.35              |
| Graphic Arts   | 2425            | AREA    | 22,948    | 0.6              | 91.95              |
| Solvent Utilization-Miscellaneous Industrial                               | 2440020000      | AREA    | 21,400    | 0.56             | 92.51              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                    | 2810020         | AREA    | 21,313    | 0.56             | 93.07              |
| Solvent Utilization-Dry Cleaning   | 2420            | AREA    | 19,075    | 0.5              | 93.57              |
| Industrial Processes-Food and Agriculture                                  | 302             | POINT   | 18,378    | 0.48             | 94.05              |
| Mobile Sources-Railroad Equipment  | 2285            | NONROAD | 16,523    | 0.43             | 94.48              |
| Petroleum and Solvent Evaporation-Petroleum Liquids Storage (non-Refinery) | 4040            | POINT   | 15,379    | 0.4              | 94.88              |
| Auto Refinishing   | 2401005000      | AREA    | 12,437    | 0.33             | 95.21              |
| External Combustion Boilers-Electric Generation                            | 1010            | POINT   | 11,695    | 0.31             | 95.52              |
| Mobile Sources-LPG   | 2267            | NONROAD | 10,752    | 0.28             | 95.8               |
| Industrial Processes-Miscellaneous Manufacturing Industries                | 399             | POINT   | 9,097     | 0.24             | 96.04              |
| External Combustion Boilers-Industrial                                     | 1020            | POINT   | 8,994     | 0.24             | 96.28              |
| Waste Disposal, Treatment, and Recovery-Wastewater Treatment               | 2630            | AREA    | 8,985     | 0.24             | 96.52              |
| Traffic Markings   | 2401008000      | AREA    | 8,631     | 0.23             | 96.75              |
| Industrial Processes-Rubber and Miscellaneous Plastics Products            | 308             | POINT   | 8,499     | 0.22             | 96.97              |
| Industrial Processes-Mineral Products                                      | 305             | POINT   | 8,280     | 0.22             | 97.19              |
| Petroleum and Solvent Evaporation-Organic Solvent Evaporation              | 401             | POINT   | 8,228     | 0.22             | 97.41              |

**Table A-1 (continued)**

| Category   | Category Number | Sector  | VOC       |                  |                    |
|--|-----------------|---------|-----------|------------------|--------------------|
|  |                 |         | Tons/Year | Percent of Total | Cumulative Percent |
| Petroleum and Solvent Evaporation-Transportation and Marketing of Petroleum Products | 406             | POINT   | 8,144     | 0.21             | 97.62              |
| Petroleum and Solvent Evaporation-Printing/Publishing                                | 405             | POINT   | 7,325     | 0.19             | 97.81              |
| Waste Disposal, Treatment, and Recovery-Landfills                                    | 2620            | AREA    | 6,452     | 0.17             | 97.98              |
| Miscellaneous Area Sources-Agricultural Production-Crops                             | 2801            | AREA    | 6,215     | 0.16             | 98.14              |
| Mobile Sources-CNG   | 2268            | NONROAD | 6,189     | 0.16             | 98.3               |
| Industrial Processes-Secondary Metal Production                                      | 304             | POINT   | 5,912     | 0.16             | 98.46              |
| Stationary Source Fuel Combustion-Industrial   | 2102            | AREA    | 5,610     | 0.15             | 98.61              |
| Mobile Sources-Aircraft  | 2275            | NONROAD | 5,337     | 0.14             | 98.75              |
| Rubber/Plastics  | 2430000000      | AREA    | 5,200     | 0.14             | 98.89              |
| Industrial Processes-Cooling Tower   | 3850            | POINT   | 4,751     | 0.12             | 99.01              |
| Industrial Processes-Food and Kindred Products: SIC 20                               | 2302            | AREA    | 3,974     | 0.1              | 99.11              |
| Mobile Sources-Marine Vessels, Commercial  | 2280            | NONROAD | 3,120     | 0.08             | 99.19              |
| Petroleum and Solvent Evaporation-Organic Chemical Storage                           | 407             | POINT   | 2,830     | 0.07             | 99.26              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                           | 2465000000      | AREA    | 2,733     | 0.07             | 99.33              |
| Industrial Processes-Primary Metal Production  | 303             | POINT   | 2,490     | 0.07             | 99.4               |
| Industrial Processes-Industrial Processes: NEC                                       | 2399            | AREA    | 2,097     | 0.06             | 99.46              |
| Waste Disposal-Solid Waste Disposal-Government                                       | 501             | POINT   | 2,073     | 0.05             | 99.51              |
| Stationary Source Fuel Combustion-Commercial/Institutional                           | 2103            | AREA    | 1,685     | 0.04             | 99.55              |
| Waste Disposal, Treatment, and Recovery-TSDFs  | 2640            | AREA    | 1,678     | 0.04             | 99.59              |
| Internal Combustion Engines-Electric Generation                                      | 2010            | POINT   | 1,602     | 0.04             | 99.63              |
| Petroleum and Solvent Evaporation-Organic Chemical Transportation                    | 4089            | POINT   | 1,529     | 0.04             | 99.67              |
| Industrial Processes-Fabricated Metal Products                                       | 309             | POINT   | 1,483     | 0.04             | 99.71              |
| Miscellaneous Area Sources-Catastrophic/Accidental Releases                          | 2830            | AREA    | 1,057     | 0.03             | 99.74              |
| Industrial Processes-In-process Fuel Use   | 390             | POINT   | 742       | 0.02             | 99.76              |
| External Combustion Boilers-Commercial/Institutional                                 | 1030            | POINT   | 653       | 0.02             | 99.78              |
| Waste Disposal, Treatment, and Recovery-On-site Incineration                         | 2601            | AREA    | 650       | 0.02             | 99.80              |
| Waste Disposal-Solid Waste Disposal-Industrial                                       | 503             | POINT   | 634       | 0.02             | 99.82              |
| Waste Disposal-Solid Waste Disposal-Commercial/Institutional                         | 502             | POINT   | 606       | 0.02             | 99.82              |
| Mobile Sources-Aircraft  | 2275            | POINT   | 599       | 0.02             | 99.84              |
| Industrial Processes-Textile Products  | 330             | POINT   | 567       | 0.01             | 99.85              |
| Industrial Processes-Machinery, Miscellaneous  | 3129            | POINT   | 529       | 0.01             | 99.86              |
| Internal Combustion Engines-Fugitive Emissions                                       | 2888            | POINT   | 508       | 0.01             | 99.87              |
| Industrial Processes-Electrical Equipment  | 313             | POINT   | 495       | 0.01             | 99.88              |
| Waste Disposal, Treatment, and Recovery-Leaking Underground Storage Tanks            | 2660            | AREA    | 459       | 0.01             | 99.89              |
| Internal Combustion Engines-Engine Testing   | 2040            | POINT   | 455       | 0.01             | 99.90              |
| Industrial Processes-Transportation Equipment  | 314             | POINT   | 379       | 0.01             | 99.91              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                                | 2265            | POINT   | 283       | 0.01             | 99.92              |
| MACT Source Categories : Vinyl-based Resins  | 6463            | POINT   | 256       | 0.01             | 99.93              |
| Internal Combustion Engines-Commercial/Institutional                                 | 2030            | POINT   | 230       | 0.01             | 99.94              |
| MACT Source Categories : Cellulose-based Resins                                      | 644             | POINT   | 221       | 0.01             | 99.95              |
| External Combustion Boilers-Space Heaters  | 1050            | POINT   | 207       | 0.01             | 99.96              |
| Industrial Processes-Leather and Leather Products                                    | 3209            | POINT   | 128       | 0                | 99.96              |
| Bulk Materials Transport & Transport   | 253             | AREA    | 108       | 0                | 99.96              |
| Petroleum and Solvent Evaporation-   | 4250            | POINT   | 104       | 0                | 99.96              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                              | 2810020         | POINT   | 79        | 0.00             | 99.96              |
| Petroleum and Solvent Evaporation : Dry Cleaning                                     | 410             | POINT   | 67        | 0.00             | 99.96              |
| Miscellaneous Area Sources-Aircraft/Rocket Engine Firing and Testing                 | 2810040         | AREA    | 66        | 0.00             | 99.97              |
| Waste Disposal, Treatment, and Recovery-Landfills                                    | 2620            | POINT   | 51        | 0.00             | 99.97              |

**Table A-1 (continued)**

| Category  | Category Number | Sector   | VOC       |                  |                    |
|---|-----------------|----------|-----------|------------------|--------------------|
|   |                 |          | Tons/Year | Percent of Total | Cumulative Percent |
| Petroleum and Solvent Evaporation : Organic Chemical Transportation                           | 4088            | POINT    | 39        | 0.00             | 99.97              |
| Mobile Sources-Highway Vehicles-Diesel  | 2230            | AREA     | 38        | 0.00             | 99.97              |
| Waste Disposal-Site Remediation   | 504             | POINT    | 35        | 0.00             | 99.97              |
| Industrial Processes-Photo Equip/Health Care/Labs/Air Condit/SwimPools                        | 3150            | POINT    | 18        | 0.00             | 99.97              |
| Mobile Sources-Off-highway Vehicle Diesel   | 2270            | POINT    | 16        | 0.00             | 100.0              |
| MACT Source Categories : Styrene or Methacrylate Based Resins                                 | 6413            | POINT    | 16        | 0.00             | 100.0              |
| MACT Source Categories-Miscellaneous Resins   | 6452            | POINT    | 12        | 0.00             | 100.0              |
| Industrial Processes-Building Construction  | 3110            | POINT    | 11        | 0.00             | 100.0              |
| MACT Source Categories : Agricultural Chemicals Production                                    | 631             | POINT    | 3         | 0.00             | 100.0              |
| MACT Source Categories-Inorganic Chemicals Manufacturing                                      | 6513            | POINT    | 2         | 0.00             | 100.0              |
| MACT Source Categories-Miscellaneous Processes (Chemicals)                                    | 6848            | POINT    | 1.0       | 0.00             | 100.0              |
| MACT Source Categories : Food and Agricultural Processes                                      | 6258            | POINT    | 0.7       | 0.00             | 100.0              |
| Mobile Sources-Aircraft   | 2275            | AREA     | 0.1       | 0.00             | 100.0              |
| MACT Source Categories-Miscellaneous Processes  | 6828            | POINT    | 0.0       | 0.00             | 100.0              |
| MACT Source Categories : Consumer Product Manufacturing Facilities                            | 6818            | POINT    | 0.0       | 0.00             | 100.0              |
| MACT Source Categories-Miscellaneous Processes  | 6824            | POINT    | 0.0       | 0.00             | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | POINT    | 0.00      | 0.00             | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | POINT    | 0.0       | 0                | 100.0              |
| Industrial Processes-Construction: SIC 15-17  | 2311            | AREA     |           | 0                | 100.0              |
| Industrial Processes-Mining and Quarrying: SIC 14   | 2325            | AREA     |           | 0                | 100.0              |
| Industrial Processes-Printing and Publishing  | 3600            | POINT    |           | 0                | 100.0              |
| Inorganic Chemical Storage & Transport  | 252             | AREA     |           | 0                | 100.0              |
| Internal Combustion Engines-Off-highway Diesel Engines  | 2700            | POINT    |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Tilling & Harvesting                 | 28010           | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Beef Cattle                       | 280500          | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Cattle and Calves Waste Emissions | 280502          | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Dairy Cattle                      | 280501          | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Goats                             | 2805045         | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Horses and Ponies                 | 2805035         | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Poultry                           | 2805030         | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Sheep and Lambs                   | 2805040         | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Swine                             | 2805025         | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Domestic Animals Waste Emissions                                   | 2806            | AREA     |           | 0                | 100.0              |
| Miscellaneous Area Sources-Wild Animals Waste Emissions                                       | 2807            | AREA     |           | 0                | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | AREA     |           | 0                | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | AREA     |           | 0                | 100.0              |
| Natural Sources, Biogenic   | 2701            | BIOGENIC |           | 0                | 100.0              |
| Natural Sources, Geogenic   | 2730            | GEOGENIC |           | 0                | 100.0              |
| Stationary Source Fuel Combustion-Electric Utility  | 2101            | AREA     |           | 0                | 100.0              |
| <b>Totals for All Categories</b>  |                 |          | 3,802,477 | 100              |                    |

**Table A-2. Summary of Annual NO<sub>x</sub> Emissions for the CENRAP Region by Category, Sector, and Pollutant: Base B Inventory**

| Category   | Category Number | Sector  | NO <sub>x</sub> |                  |                    |
|--|-----------------|---------|-----------------|------------------|--------------------|
|  |                 |         | Tons/Year       | Percent of Total | Cumulative Percent |
| External Combustion Boilers-Electric Generation                        | 1010            | POINT   | 895,567         | 17.21            | 17.21              |
| Mobile Sources-Highway Vehicles-Diesel                                 | 2230            | ON-ROAD | 890,699         | 17.11            | 34.32              |
| Mobile Sources-Highway Vehicles-Gasoline                               | 2201            | ON-ROAD | 845,039         | 16.24            | 50.56              |
| Mobile Sources-Off-highway Vehicle Diesel                              | 2270            | NONROAD | 392,833         | 7.55             | 58.11              |
| Internal Combustion Engines-Industrial                                 | 2020            | POINT   | 378,374         | 7.27             | 65.38              |
| Mobile Sources-Railroad Equipment                                      | 2285            | NONROAD | 331,552         | 6.37             | 71.75              |
| Industrial Processes-Oil and Gas Production: SIC 13                    | 2310            | AREA    | 277,190         | 5.33             | 77.08              |
| Stationary Source Fuel Combustion-Industrial                           | 2102            | AREA    | 222,299         | 4.27             | 81.35              |
| External Combustion Boilers-Industrial                                 | 1020            | POINT   | 182,295         | 3.5              | 84.85              |
| Mobile Sources-Marine Vessels, Commercial                              | 2280            | NONROAD | 123,773         | 2.38             | 87.23              |
| Industrial Processes-Mineral Products                                  | 305             | POINT   | 91,145          | 1.75             | 88.98              |
| Industrial Processes-Petroleum Industry                                | 306             | POINT   | 69,932          | 1.34             | 90.32              |
| Industrial Processes-Chemical Manufacturing                            | 301             | POINT   | 60,691          | 1.17             | 91.49              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Field Burning | 28015           | AREA    | 58,189          | 1.12             | 92.61              |
| Stationary Source Fuel Combustion-Residential                          | 2104            | AREA    | 50,497          | 0.97             | 93.58              |
| Mobile Sources-LPG   | 2267            | NONROAD | 40,521          | 0.78             | 94.36              |
| Stationary Source Fuel Combustion-Commercial/Institutional             | 2103            | AREA    | 33,940          | 0.65             | 95.01              |
| Internal Combustion Engines-Electric Generation                        | 2010            | POINT   | 33,854          | 0.65             | 95.66              |
| Industrial Processes-In-process Fuel Use                               | 390             | POINT   | 31,703          | 0.61             | 96.27              |
| Mobile Sources-Pleasure Craft  | 2282            | NONROAD | 25,375          | 0.49             | 96.76              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                  | 2265            | NONROAD | 23,558          | 0.45             | 97.21              |
| Industrial Processes-Oil and Gas Production                            | 310             | POINT   | 16,172          | 0.31             | 97.52              |
| Mobile Sources-Aircraft  | 2275            | NONROAD | 15,299          | 0.29             | 97.81              |
| Industrial Processes-Primary Metal Production                          | 303             | POINT   | 13,009          | 0.25             | 98.06              |
| Industrial Processes-Pulp and Paper and Wood Products                  | 307             | POINT   | 12,342          | 0.24             | 98.3               |
| Miscellaneous Area Sources-Other Combustion                            | 2810            | AREA    | 10,653          | 0.2              | 98.5               |
| Open Burning-Waste Disposal, Treatment, and Recovery                   | 261             | AREA    | 9,875           | 0.19             | 98.69              |
| Mobile Sources-CNG   | 2268            | NONROAD | 8,392           | 0.16             | 98.85              |
| External Combustion Boilers-Commercial/Institutional                   | 1030            | POINT   | 7,118           | 0.14             | 98.99              |
| Internal Combustion Engines-Commercial/Institutional                   | 2030            | POINT   | 5,919           | 0.11             | 99.1               |
| Petroleum and Petroleum Product Storage & Transport-Other              | 250             | AREA    | 4,941           | 0.09             | 99.19              |
| Miscellaneous Area Sources-Other Combustion                            | 2810            | POINT   | 4,068           | 0.08             | 99.27              |
| Industrial Processes-Secondary Metal Production                        | 304             | POINT   | 3,867           | 0.07             | 99.34              |
| Waste Disposal-Solid Waste Disposal-Government                         | 501             | POINT   | 3,717           | 0.07             | 99.41              |
| Industrial Processes-Miscellaneous Manufacturing Industries            | 399             | POINT   | 3,702           | 0.07             | 99.48              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                | 2810020         | AREA    | 3,563           | 0.07             | 99.55              |
| Mobile Sources-Off-highway Vehicle Gasoline, 2-Stroke                  | 2260            | NONROAD | 2,767           | 0.05             | 99.6               |
| Miscellaneous Area Sources-Agricultural Production-Crops               | 2801            | AREA    | 2,758           | 0.05             | 99.65              |
| Bulk Materials Transport & Transport                                   | 253             | AREA    | 2,354           | 0.05             | 99.7               |
| Industrial Processes-Food and Agriculture                              | 302             | POINT   | 2,057           | 0.04             | 99.74              |
| Mobile Sources-Aircraft  | 2275            | POINT   | 1,825           | 0.04             | 99.78              |
| Industrial Processes-Rubber and Miscellaneous Plastics Products        | 308             | POINT   | 1,743           | 0.03             | 99.81              |
| Waste Disposal-Solid Waste Disposal-Industrial                         | 503             | POINT   | 1,386           | 0.03             | 99.84              |
| Waste Disposal, Treatment, and Recovery-On-site Incineration           | 2601            | AREA    | 1,289           | 0.02             | 99.86              |
| Industrial Processes-Mining and Quarrying: SIC 14                      | 2325            | AREA    | 1,190           | 0.02             | 99.88              |
| Internal Combustion Engines-Engine Testing                             | 2040            | POINT   | 863             | 0.02             | 99.9               |

**Table A-2 (continued)**

| Category   | Category Number | Sector | NO <sub>x</sub> |                  |                    |
|--|-----------------|--------|-----------------|------------------|--------------------|
|  |                 |        | Tons/Year       | Percent of Total | Cumulative Percent |
| Petroleum and Solvent Evaporation-Surface Coating Operations                         | 402             | POINT  | 691             | 0.01             | 99.91              |
| Industrial Processes-Industrial Processes: NEC                                       | 2399            | AREA   | 616             | 0.01             | 99.92              |
| External Combustion Boilers-Space Heaters  | 1050            | POINT  | 586             | 0.01             | 99.93              |
| Waste Disposal-Site Remediation  | 504             | POINT  | 535             | 0.01             | 99.94              |
| Industrial Processes-Fabricated Metal Products                                       | 309             | POINT  | 480             | 0.01             | 99.95              |
| Miscellaneous Area Sources-Aircraft/Rocket Engine Firing and Testing                 | 2810040         | AREA   | 285             | 0.01             | 99.96              |
| Mobile Sources-Highway Vehicles-Diesel   | 2230            | AREA   | 283             | 0.01             | 99.97              |
| Waste Disposal-Solid Waste Disposal-Commercial/Institutional                         | 502             | POINT  | 209             | 0.00             | 99.97              |
| Mobile Sources-Off-highway Vehicle Diesel  | 2270            | POINT  | 208             | 0.00             | 99.97              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                                | 2265            | POINT  | 188             | 0.00             | 99.97              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                              | 2810020         | POINT  | 157             | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-Organic Solvent Evaporation                        | 401             | POINT  | 152             | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-Transportation and Marketing of Petroleum Products | 406             | POINT  | 109             | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-Petroleum Liquids Storage (non-Refinery)           | 4040            | POINT  | 98              | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-Printing/Publishing                                | 405             | POINT  | 90              | 0.00             | 99.97              |
| Industrial Processes-Electrical Equipment  | 313             | POINT  | 82              | 0.00             | 99.97              |
| Industrial Processes-Machinery, Miscellaneous  | 3129            | POINT  | 66              | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-Petroleum Product Storage at Refineries            | 403             | POINT  | 48              | 0.00             | 99.97              |
| Internal Combustion Engines-Fugitive Emissions                                       | 2888            | POINT  | 26              | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-Organic Chemical Transportation                    | 4089            | POINT  | 18              | 0.00             | 99.97              |
| MACT Source Categories : Vinyl-based Resins  | 6463            | POINT  | 11              | 0.00             | 99.97              |
| Solvent Utilization-Miscellaneous Non-industrial: Commercial                         | 24610 - 24      | AREA   | 10              | 0.00             | 99.97              |
| Industrial Processes-Transportation Equipment  | 314             | POINT  | 6               | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-   | 4250            | POINT  | 4               | 0.00             | 99.97              |
| Internal Combustion Engines-Off-highway Diesel Engines                               | 2700            | POINT  | 4               | 0.00             | 99.97              |
| Petroleum and Solvent Evaporation-Organic Chemical Storage                           | 407             | POINT  | 4               | 0.00             | 99.97              |
| Industrial Processes-Textile Products  | 330             | POINT  | 3               | 0.00             | 99.97              |
| Industrial Processes-Building Construction   | 3110            | POINT  | 1               | 0.00             | 99.97              |
| Industrial Processes-Cooling Tower   | 3850            | POINT  | 1               | 0.00             | 99.97              |
| MACT Source Categories : Cellulose-based Resins                                      | 644             | POINT  | 0               | 0.00             | 99.97              |
| Industrial Processes-Photo Equip/Health Care/Labs/Air Condit/SwimPools               | 3150            | POINT  | 0               | 0.00             | 100.0              |
| Miscellaneous Area Sources-Catastrophic/Accidental Releases                          | 2830            | AREA   | 0               | 0                | 100.0              |
| MACT Source Categories-Inorganic Chemicals Manufacturing                             | 6513            | POINT  | 0               | 0                | 100.0              |
| MACT Source Categories : Consumer Product Manufacturing Facilities                   | 6818            | POINT  | 0               | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes (Chemicals)                           | 6848            | POINT  | 0               | 0                | 100.0              |
| Mobile Sources-Paved Roads   | 2294            | POINT  | 0               | 0                | 100.0              |
| Mobile Sources-Unpaved Roads   | 2296            | POINT  | 0               | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Organic Chemical Transportation                  | 4088            | POINT  | 0               | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills                                    | 2620            | POINT  | 0               | 0                | 100.0              |
| Architectural Coatings   | 2401001000      | AREA   |                 | 0                | 100.0              |
| Auto Refinishing   | 2401005000      | AREA   |                 | 0                | 100.0              |
| Degreasing   | 2415            | AREA   |                 | 0                | 100.0              |
| Gas Marketing Stage I  | 25010600        | AREA   |                 | 0                | 100.0              |
| Graphic Arts   | 2425            | AREA   |                 | 0                | 100.0              |
| Industrial Processes-Construction: SIC 15-17   | 2311            | AREA   |                 | 0                | 100.0              |

**Table A-2 (continued)**

| Category  | Category Number | Sector   | NO <sub>x</sub> |                  |                    |
|---|-----------------|----------|-----------------|------------------|--------------------|
|   |                 |          | Tons/Year       | Percent of Total | Cumulative Percent |
| Industrial Processes-Food and Kindred Products: SIC 20  | 2302            | AREA     |                 | 0                | 100.0              |
| Industrial Processes-Leather and Leather Products   | 3209            | POINT    |                 | 0                | 100.0              |
| Industrial Processes-Printing and Publishing  | 3600            | POINT    |                 | 0                | 100.0              |
| Industrial Surface Coating  | 2401015000      | AREA     |                 | 0                | 100.0              |
| Inorganic Chemical Storage & Transport  | 252             | AREA     |                 | 0                | 100.0              |
| MACT Source Categories : Agricultural Chemicals Production                                    | 631             | POINT    |                 | 0                | 100.0              |
| MACT Source Categories : Food and Agricultural Processes                                      | 6258            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories : Styrene or Methacrylate Based Resins                                 | 6413            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes  | 6824            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes  | 6828            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Resins   | 6452            | POINT    |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Tilling & Harvesting                 | 28010           | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Beef Cattle                       | 280500          | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Cattle and Calves Waste Emissions | 280502          | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Dairy Cattle                      | 280501          | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Goats                             | 2805045         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Horses and Ponies                 | 2805035         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Poultry                           | 2805030         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Sheep and Lambs                   | 2805040         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Swine                             | 2805025         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Domestic Animals Waste Emissions                                   | 2806            | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Wild Animals Waste Emissions                                       | 2807            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Aircraft   | 2275            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | AREA     |                 | 0                | 100.0              |
| Natural Sources, Biogenic   | 2701            | BIOGENIC |                 | 0                | 100.0              |
| Natural Sources, Geogenic   | 2730            | GEOGENIC |                 | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Dry Cleaning  | 410             | POINT    |                 | 0                | 100.0              |
| Rubber/Plastics   | 2430000000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Dry Cleaning  | 2420            | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Industrial  | 2440020000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465            | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465000000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer and Commercial                     | 24600 - 24      | AREA     |                 | 0                | 100.0              |
| Stationary Source Fuel Combustion-Electric Utility  | 2101            | AREA     |                 | 0                | 100.0              |
| Traffic Markings  | 2401008000      | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills   | 2620            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Leaking Underground Storage Tanks                     | 2660            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-TSDFs   | 2640            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Wastewater Treatment                                  | 2630            | AREA     |                 | 0                | 100.0              |
| <b>Totals for All Categories</b>  |                 |          | 5,204,868       | 100              |                    |

**Table A-3. Summary of Annual CO Emissions for the CENRAP Region by Category, Sector, and Pollutant: Base B Inventory**

| Category   | Category Number | Sector  | CO         |                  |                    |
|--|-----------------|---------|------------|------------------|--------------------|
|  |                 |         | Tons/Year  | Percent of Total | Cumulative Percent |
| Mobile Sources-Highway Vehicles-Gasoline                               | 2201            | ON-ROAD | 12,622,725 | 56.09            | 56.09              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                  | 2265            | NONROAD | 2,488,595  | 11.06            | 67.15              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Field Burning | 28015           | AREA    | 1,363,848  | 6.06             | 73.21              |
| Mobile Sources-Pleasure Craft  | 2282            | NONROAD | 1,030,752  | 4.58             | 77.79              |
| Miscellaneous Area Sources-Other Combustion                            | 2810            | AREA    | 904,171    | 4.02             | 81.81              |
| Miscellaneous Area Sources-Other Combustion                            | 2810            | POINT   | 688,449    | 3.06             | 84.87              |
| Stationary Source Fuel Combustion-Residential                          | 2104            | AREA    | 404,209    | 1.8              | 86.67              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                | 2810020         | AREA    | 324,217    | 1.44             | 88.11              |
| External Combustion Boilers-Electric Generation                        | 1010            | POINT   | 275,860    | 1.23             | 89.34              |
| Mobile Sources-Off-highway Vehicle Gasoline, 2-Stroke                  | 2260            | NONROAD | 268,369    | 1.19             | 90.53              |
| Industrial Processes-Oil and Gas Production: SIC 13                    | 2310            | AREA    | 240,677    | 1.07             | 91.6               |
| Open Burning-Waste Disposal, Treatment, and Recovery                   | 261             | AREA    | 238,628    | 1.06             | 92.66              |
| Mobile Sources-Off-highway Vehicle Diesel                              | 2270            | NONROAD | 236,540    | 1.05             | 93.71              |
| Industrial Processes-Chemical Manufacturing                            | 301             | POINT   | 169,431    | 0.75             | 94.46              |
| Mobile Sources-LPG   | 2267            | NONROAD | 162,171    | 0.72             | 95.18              |
| Mobile Sources-Highway Vehicles-Diesel                                 | 2230            | ON-ROAD | 160,085    | 0.71             | 95.89              |
| Internal Combustion Engines-Industrial                                 | 2020            | POINT   | 152,398    | 0.68             | 96.57              |
| External Combustion Boilers-Industrial                                 | 1020            | POINT   | 120,770    | 0.54             | 97.11              |
| Industrial Processes-Primary Metal Production                          | 303             | POINT   | 97,211     | 0.43             | 97.54              |
| Industrial Processes-Mineral Products                                  | 305             | POINT   | 63,408     | 0.28             | 97.82              |
| Mobile Sources-Aircraft  | 2275            | NONROAD | 58,554     | 0.26             | 98.08              |
| Stationary Source Fuel Combustion-Industrial                           | 2102            | AREA    | 56,095     | 0.25             | 98.33              |
| Miscellaneous Area Sources-Agricultural Production-Crops               | 2801            | AREA    | 55,100     | 0.24             | 98.57              |
| Industrial Processes-Petroleum Industry                                | 306             | POINT   | 52,733     | 0.23             | 98.8               |
| Mobile Sources-Railroad Equipment                                      | 2285            | NONROAD | 43,352     | 0.19             | 98.99              |
| Industrial Processes-Pulp and Paper and Wood Products                  | 307             | POINT   | 38,549     | 0.17             | 99.16              |
| Mobile Sources-CNG   | 2268            | NONROAD | 34,154     | 0.15             | 99.31              |
| Stationary Source Fuel Combustion-Commercial/Institutional             | 2103            | AREA    | 19,925     | 0.09             | 99.4               |
| Industrial Processes-Secondary Metal Production                        | 304             | POINT   | 19,360     | 0.09             | 99.49              |
| Mobile Sources-Marine Vessels, Commercial                              | 2280            | NONROAD | 18,111     | 0.08             | 99.57              |
| Industrial Processes-Food and Agriculture                              | 302             | POINT   | 13,552     | 0.06             | 99.63              |
| Industrial Processes-Oil and Gas Production                            | 310             | POINT   | 10,508     | 0.05             | 99.68              |
| Internal Combustion Engines-Electric Generation                        | 2010            | POINT   | 10,049     | 0.04             | 99.72              |
| Mobile Sources-Aircraft  | 2275            | POINT   | 9,552      | 0.04             | 99.76              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                  | 2265            | POINT   | 7,992      | 0.04             | 99.8               |
| Industrial Processes-In-process Fuel Use                               | 390             | POINT   | 6,918      | 0.03             | 99.83              |
| External Combustion Boilers-Commercial/Institutional                   | 1030            | POINT   | 6,390      | 0.03             | 99.86              |
| Industrial Processes-Food and Kindred Products: SIC 20                 | 2302            | AREA    | 5,540      | 0.02             | 99.88              |
| Industrial Processes-Miscellaneous Manufacturing Industries            | 399             | POINT   | 4,292      | 0.02             | 99.9               |
| Waste Disposal-Solid Waste Disposal-Government                         | 501             | POINT   | 4,096      | 0.02             | 99.92              |
| Waste Disposal, Treatment, and Recovery-On-site Incineration           | 2601            | AREA    | 3,687      | 0.02             | 99.94              |
| Internal Combustion Engines-Commercial/Institutional                   | 2030            | POINT   | 3,243      | 0.01             | 99.95              |
| Waste Disposal-Solid Waste Disposal-Industrial                         | 503             | POINT   | 1,367      | 0.01             | 99.96              |
| Internal Combustion Engines-Engine Testing                             | 2040            | POINT   | 1,306      | 0.01             | 99.97              |
| Miscellaneous Area Sources-Aircraft/Rocket Engine Firing and Testing   | 2810040         | AREA    | 999        | 0                | 99.97              |

**Table A-3 (continued)**

| Category   | Category Number | Sector | CO        |                  |                    |
|--|-----------------|--------|-----------|------------------|--------------------|
|  |                 |        | Tons/Year | Percent of Total | Cumulative Percent |
| Waste Disposal-Solid Waste Disposal-Commercial/Institutional                         | 502             | POINT  | 733       | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Surface Coating Operations                         | 402             | POINT  | 510       | 0                | 99.97              |
| Mobile Sources-Highway Vehicles-Diesel   | 2230            | AREA   | 454       | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Organic Solvent Evaporation                        | 401             | POINT  | 386       | 0                | 99.97              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                              | 2810020         | POINT  | 340       | 0                | 99.97              |
| Bulk Materials Transport & Transport   | 253             | AREA   | 305       | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Transportation and Marketing of Petroleum Products | 406             | POINT  | 278       | 0                | 99.97              |
| External Combustion Boilers-Space Heaters  | 1050            | POINT  | 258       | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Petroleum Liquids Storage (non-Refinery)           | 4040            | POINT  | 237       | 0                | 99.97              |
| Industrial Processes-Rubber and Miscellaneous Plastics Products                      | 308             | POINT  | 213       | 0                | 99.97              |
| Industrial Processes-Fabricated Metal Products                                       | 309             | POINT  | 191       | 0                | 99.97              |
| Industrial Processes-Industrial Processes: NEC                                       | 2399            | AREA   | 140       | 0                | 99.97              |
| Internal Combustion Engines-Fugitive Emissions                                       | 2888            | POINT  | 135       | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Petroleum Product Storage at Refineries            | 403             | POINT  | 128       | 0                | 99.97              |
| Waste Disposal-Site Remediation  | 504             | POINT  | 116       | 0                | 99.97              |
| Industrial Processes-Machinery, Miscellaneous  | 3129            | POINT  | 72        | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Organic Chemical Transportation                    | 4089            | POINT  | 66        | 0                | 99.97              |
| Mobile Sources-Off-highway Vehicle Diesel  | 2270            | POINT  | 56        | 0                | 99.97              |
| Industrial Processes-Electrical Equipment  | 313             | POINT  | 51        | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Organic Chemical Storage                           | 407             | POINT  | 48        | 0                | 99.97              |
| Petroleum and Solvent Evaporation-Printing/Publishing                                | 405             | POINT  | 30        | 0                | 99.97              |
| MACT Source Categories-Miscellaneous Processes (Chemicals)                           | 6848            | POINT  | 20        | 0                | 99.97              |
| Petroleum and Solvent Evaporation-   | 4250            | POINT  | 9         | 0                | 99.97              |
| MACT Source Categories : Vinyl-based Resins  | 6463            | POINT  | 9         | 0                | 99.97              |
| Industrial Processes-Transportation Equipment  | 314             | POINT  | 3         | 0                | 99.97              |
| Industrial Processes-Leather and Leather Products                                    | 3209            | POINT  | 2         | 0                | 99.97              |
| Industrial Processes-Textile Products  | 330             | POINT  | 2         | 0                | 99.97              |
| Internal Combustion Engines-Off-highway Diesel Engines                               | 2700            | POINT  | 2         | 0                | 99.97              |
| Waste Disposal, Treatment, and Recovery-Landfills                                    | 2620            | POINT  | 1         | 0                | 99.97              |
| Industrial Processes-Cooling Tower   | 3850            | POINT  | 1         | 0                | 99.97              |
| MACT Source Categories : Cellulose-based Resins                                      | 644             | POINT  | 0         | 0                | 99.97              |
| Industrial Processes-Photo Equip/Health Care/Labs/Air Condit/SwimPools               | 3150            | POINT  | 0         | 0                | 100.0              |
| Industrial Processes-Building Construction   | 3110            | POINT  | 0         | 0                | 100.0              |
| MACT Source Categories : Consumer Product Manufacturing Facilities                   | 6818            | POINT  | 0         | 0                | 100.0              |
| Mobile Sources-Paved Roads   | 2294            | POINT  | 0         | 0                | 100.0              |
| Mobile Sources-Unpaved Roads   | 2296            | POINT  | 0         | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Organic Chemical Transportation                  | 4088            | POINT  | 0         | 0                | 100.0              |
| Architectural Coatings   | 2401001000      | AREA   |           | 0                | 100.0              |
| Auto Refinishing   | 2401005000      | AREA   |           | 0                | 100.0              |
| Degreasing   | 2415            | AREA   |           | 0                | 100.0              |
| Gas Marketing Stage I  | 25010600        | AREA   |           | 0                | 100.0              |
| Graphic Arts   | 2425            | AREA   |           | 0                | 100.0              |
| Industrial Processes-Construction: SIC 15-17   | 2311            | AREA   |           | 0                | 100.0              |
| Industrial Processes-Mining and Quarrying: SIC 14                                    | 2325            | AREA   |           | 0                | 100.0              |
| Industrial Processes-Printing and Publishing   | 3600            | POINT  |           | 0                | 100.0              |
| Industrial Surface Coating   | 2401015000      | AREA   |           | 0                | 100.0              |
| Inorganic Chemical Storage & Transport   | 252             | AREA   |           | 0                | 100.0              |
| MACT Source Categories : Agricultural Chemicals Production                           | 631             | POINT  |           | 0                | 100.0              |



**Table A-3 (continued)**

| Category  | Category Number | Sector   | CO         |                  |                    |
|---|-----------------|----------|------------|------------------|--------------------|
|   |                 |          | Tons/Year  | Percent of Total | Cumulative Percent |
| MACT Source Categories : Food and Agricultural Processes                                      | 6258            | POINT    |            | 0                | 100.0              |
| MACT Source Categories : Styrene or Methacrylate Based Resins                                 | 6413            | POINT    |            | 0                | 100.0              |
| MACT Source Categories-Inorganic Chemicals Manufacturing                                      | 6513            | POINT    |            | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes  | 6824            | POINT    |            | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes  | 6828            | POINT    |            | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Resins   | 6452            | POINT    |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Tilling & Harvesting                 | 28010           | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Beef Cattle                       | 280500          | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Cattle and Calves Waste Emissions | 280502          | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Dairy Cattle                      | 280501          | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Goats                             | 2805045         | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Horses and Ponies                 | 2805035         | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Poultry                           | 2805030         | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Sheep and Lambs                   | 2805040         | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Swine                             | 2805025         | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Catastrophic/Accidental Releases                                   | 2830            | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Domestic Animals Waste Emissions                                   | 2806            | AREA     |            | 0                | 100.0              |
| Miscellaneous Area Sources-Wild Animals Waste Emissions                                       | 2807            | AREA     |            | 0                | 100.0              |
| Mobile Sources-Aircraft   | 2275            | AREA     |            | 0                | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | AREA     |            | 0                | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | AREA     |            | 0                | 100.0              |
| Natural Sources, Biogenic   | 2701            | BIOGENIC |            | 0                | 100.0              |
| Natural Sources, Geogenic   | 2730            | GEOGENIC |            | 0                | 100.0              |
| Petroleum and Petroleum Product Storage & Transport-Other                                     | 250             | AREA     |            | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Dry Cleaning  | 410             | POINT    |            | 0                | 100.0              |
| Rubber/Plastics   | 2430000000      | AREA     |            | 0                | 100.0              |
| Solvent Utilization-Dry Cleaning  | 2420            | AREA     |            | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Industrial  | 2440020000      | AREA     |            | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Commercial                                  | 24610 - 24      | AREA     |            | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465            | AREA     |            | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465000000      | AREA     |            | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer and Commercial                     | 24600 - 24      | AREA     |            | 0                | 100.0              |
| Stationary Source Fuel Combustion-Electric Utility  | 2101            | AREA     |            | 0                | 100.0              |
| Traffic Markings  | 2401008000      | AREA     |            | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills   | 2620            | AREA     |            | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Leaking Underground Storage Tanks                     | 2660            | AREA     |            | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-TSDFs   | 2640            | AREA     |            | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Wastewater Treatment                                  | 2630            | AREA     |            | 0                | 100.0              |
| <b>Totals for All Categories</b>  |                 |          | 22,502,730 | 100              |                    |

**Table A-4. Summary of Annual SO<sub>2</sub> Emissions for the CENRAP Region by Category, Sector, and Pollutant: Base B Inventory**

| Category   | Category Number | Sector  | SO <sub>2</sub> |                  |                    |
|--|-----------------|---------|-----------------|------------------|--------------------|
|  |                 |         | Tons/Year       | Percent of Total | Cumulative Percent |
| External Combustion Boilers-Electric Generation                                      | 1010            | POINT   | 1,507,468       | 56.1             | 56.1               |
| Stationary Source Fuel Combustion-Industrial   | 2102            | AREA    | 268,450         | 9.99             | 66.09              |
| External Combustion Boilers-Industrial   | 1020            | POINT   | 213,271         | 7.94             | 74.03              |
| Industrial Processes-Chemical Manufacturing  | 301             | POINT   | 144,912         | 5.39             | 79.42              |
| Industrial Processes-Petroleum Industry  | 306             | POINT   | 109,962         | 4.09             | 83.51              |
| Industrial Processes-Mineral Products  | 305             | POINT   | 79,767          | 2.97             | 86.48              |
| Industrial Processes-Primary Metal Production  | 303             | POINT   | 67,735          | 2.52             | 89                 |
| Mobile Sources-Off-highway Vehicle Diesel  | 2270            | NONROAD | 49,754          | 1.85             | 90.85              |
| Mobile Sources-Highway Vehicles-Gasoline   | 2201            | ON-ROAD | 31,090          | 1.16             | 92.01              |
| Industrial Processes-Oil and Gas Production  | 310             | POINT   | 30,483          | 1.13             | 93.14              |
| Mobile Sources-Railroad Equipment  | 2285            | NONROAD | 21,825          | 0.81             | 93.95              |
| Industrial Processes-Secondary Metal Production                                      | 304             | POINT   | 20,993          | 0.78             | 94.73              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Field Burning               | 28015           | AREA    | 19,669          | 0.73             | 95.46              |
| Mobile Sources-Marine Vessels, Commercial  | 2280            | NONROAD | 19,342          | 0.72             | 96.18              |
| Stationary Source Fuel Combustion-Commercial/Institutional                           | 2103            | AREA    | 18,546          | 0.69             | 96.87              |
| Mobile Sources-Highway Vehicles-Diesel   | 2230            | ON-ROAD | 16,555          | 0.62             | 97.49              |
| Industrial Processes-In-process Fuel Use   | 390             | POINT   | 11,995          | 0.45             | 97.94              |
| Industrial Processes-Miscellaneous Manufacturing Industries                          | 399             | POINT   | 8,586           | 0.32             | 98.26              |
| Stationary Source Fuel Combustion-Residential  | 2104            | AREA    | 7,817           | 0.29             | 98.55              |
| External Combustion Boilers-Commercial/Institutional                                 | 1030            | POINT   | 7,470           | 0.28             | 98.83              |
| Industrial Processes-Pulp and Paper and Wood Products                                | 307             | POINT   | 6,432           | 0.24             | 99.07              |
| Miscellaneous Area Sources-Other Combustion  | 2810            | AREA    | 4,776           | 0.18             | 99.25              |
| Miscellaneous Area Sources-Other Combustion  | 2810            | POINT   | 3,468           | 0.13             | 99.38              |
| Mobile Sources-Pleasure Craft  | 2282            | NONROAD | 1,773           | 0.07             | 99.45              |
| Industrial Processes-Food and Agriculture  | 302             | POINT   | 1,673           | 0.06             | 99.51              |
| Waste Disposal-Solid Waste Disposal-Industrial                                       | 503             | POINT   | 1,595           | 0.06             | 99.57              |
| Petroleum and Solvent Evaporation-Petroleum Product Storage at Refineries            | 403             | POINT   | 1,589           | 0.06             | 99.63              |
| Mobile Sources-Aircraft  | 2275            | NONROAD | 1,511           | 0.06             | 99.69              |
| Waste Disposal-Solid Waste Disposal-Government                                       | 501             | POINT   | 1,164           | 0.04             | 99.73              |
| Internal Combustion Engines-Industrial   | 2020            | POINT   | 1,163           | 0.04             | 99.77              |
| Internal Combustion Engines-Electric Generation                                      | 2010            | POINT   | 1,004           | 0.04             | 99.81              |
| Petroleum and Solvent Evaporation-Organic Solvent Evaporation                        | 401             | POINT   | 748             | 0.03             | 99.84              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                                | 2265            | NONROAD | 731             | 0.03             | 99.87              |
| Open Burning-Waste Disposal, Treatment, and Recovery                                 | 261             | AREA    | 694             | 0.03             | 99.9               |
| Waste Disposal, Treatment, and Recovery-On-site Incineration                         | 2601            | AREA    | 680             | 0.03             | 99.93              |
| Waste Disposal-Site Remediation  | 504             | POINT   | 635             | 0.02             | 99.95              |
| Industrial Processes-Industrial Processes: NEC                                       | 2399            | AREA    | 307             | 0.01             | 99.96              |
| Mobile Sources-Off-highway Vehicle Gasoline, 2-Stroke                                | 2260            | NONROAD | 277             | 0.01             | 99.97              |
| Petroleum and Solvent Evaporation-Transportation and Marketing of Petroleum Products | 406             | POINT   | 204             | 0.01             | 99.98              |
| Mobile Sources-Aircraft  | 2275            | POINT   | 183             | 0.01             | 99.99              |
| Bulk Materials Transport & Transport   | 253             | AREA    | 172             | 0.01             | 100.0              |
| Internal Combustion Engines-Commercial/Institutional                                 | 2030            | POINT   | 150             | 0.01             | 100.0              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                              | 2810020         | AREA    | 99              | 0                | 100.0              |
| Mobile Sources-LPG   | 2267            | NONROAD | 76              | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Organic Chemical Storage                           | 407             | POINT   | 61              | 0                | 100.0              |
| Internal Combustion Engines-Engine Testing   | 2040            | POINT   | 53              | 0                | 100.0              |

**Table A-4 (continued)**

| Category   | Category Number | Sector  | SO <sub>2</sub> |                  |                    |
|--|-----------------|---------|-----------------|------------------|--------------------|
|  |                 |         | Tons/Year       | Percent of Total | Cumulative Percent |
| Industrial Processes-Fabricated Metal Products                             | 309             | POINT   | 52              | 0                | 100.0              |
| Waste Disposal-Solid Waste Disposal-Commercial/Institutional               | 502             | POINT   | 48              | 0                | 100.0              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                    | 2810020         | POINT   | 47              | 0                | 100.0              |
| Mobile Sources-Off-highway Vehicle Diesel                                  | 2270            | POINT   | 30              | 0                | 100.0              |
| Mobile Sources-CNG   | 2268            | NONROAD | 16              | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Surface Coating Operations               | 402             | POINT   | 13              | 0                | 100.0              |
| Miscellaneous Area Sources-Aircraft/Rocket Engine Firing and Testing       | 2810040         | AREA    | 13              | 0                | 100.0              |
| External Combustion Boilers-Space Heaters                                  | 1050            | POINT   | 12              | 0                | 100.0              |
| Industrial Processes-Electrical Equipment                                  | 313             | POINT   | 9               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Organic Chemical Transportation          | 4089            | POINT   | 5               | 0                | 100.0              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                      | 2265            | POINT   | 5               | 0                | 100.0              |
| Industrial Processes-Transportation Equipment                              | 314             | POINT   | 4               | 0                | 100.0              |
| Industrial Processes-Rubber and Miscellaneous Plastics Products            | 308             | POINT   | 4               | 0                | 100.0              |
| Industrial Processes-Machinery, Miscellaneous                              | 3129            | POINT   | 3               | 0                | 100.0              |
| Industrial Processes-Cooling Tower   | 3850            | POINT   | 2               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Petroleum Liquids Storage (non-Refinery) | 4040            | POINT   | 1               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Printing/Publishing                      | 405             | POINT   | 1               | 0                | 100.0              |
| Internal Combustion Engines-Fugitive Emissions                             | 2888            | POINT   | 1               | 0                | 100.0              |
| MACT Source Categories : Vinyl-based Resins                                | 6463            | POINT   | 0               | 0                | 100.0              |
| MACT Source Categories : Cellulose-based Resins                            | 644             | POINT   | 0               | 0                | 100.0              |
| Industrial Processes-Building Construction                                 | 3110            | POINT   | 0               | 0                | 100.0              |
| Industrial Processes-Photo Equip/Health Care/Labs/Air Condit/SwimPools     | 3150            | POINT   | 0               | 0                | 100.0              |
| Industrial Processes-Textile Products                                      | 330             | POINT   | 0               | 0                | 100.0              |
| Internal Combustion Engines-Off-highway Diesel Engines                     | 2700            | POINT   | 0               | 0                | 100.0              |
| MACT Source Categories : Consumer Product Manufacturing Facilities         | 6818            | POINT   | 0               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-   | 4250            | POINT   | 0               | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Organic Chemical Transportation        | 4088            | POINT   | 0               | 0                | 100.0              |
| Architectural Coatings   | 2401001000      | AREA    |                 | 0                | 100.0              |
| Auto Refinishing   | 2401005000      | AREA    |                 | 0                | 100.0              |
| Degreasing   | 2415            | AREA    |                 | 0                | 100.0              |
| Gas Marketing Stage I  | 25010600        | AREA    |                 | 0                | 100.0              |
| Graphic Arts   | 2425            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Construction: SIC 15-17                               | 2311            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Food and Kindred Products: SIC 20                     | 2302            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Leather and Leather Products                          | 3209            | POINT   |                 | 0                | 100.0              |
| Industrial Processes-Mining and Quarrying: SIC 14                          | 2325            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Oil and Gas Production: SIC 13                        | 2310            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Printing and Publishing                               | 3600            | POINT   |                 | 0                | 100.0              |
| Industrial Surface Coating   | 2401015000      | AREA    |                 | 0                | 100.0              |
| Inorganic Chemical Storage & Transport                                     | 252             | AREA    |                 | 0                | 100.0              |
| MACT Source Categories : Agricultural Chemicals Production                 | 631             | POINT   |                 | 0                | 100.0              |
| MACT Source Categories : Food and Agricultural Processes                   | 6258            | POINT   |                 | 0                | 100.0              |
| MACT Source Categories : Styrene or Methacrylate Based Resins              | 6413            | POINT   |                 | 0                | 100.0              |
| MACT Source Categories-Inorganic Chemicals Manufacturing                   | 6513            | POINT   |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes                             | 6824            | POINT   |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes                             | 6828            | POINT   |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes (Chemicals)                 | 6848            | POINT   |                 | 0                | 100.0              |

**Table A-4 (continued)**

| Category  | Category Number | Sector   | SO <sub>2</sub> |                  |                    |
|---|-----------------|----------|-----------------|------------------|--------------------|
|   |                 |          | Tons/Year       | Percent of Total | Cumulative Percent |
| MACT Source Categories-Miscellaneous Resins   | 6452            | POINT    |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agricultural Production-Crops                                      | 2801            | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Tilling & Harvesting                 | 28010           | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Beef Cattle                       | 280500          | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Cattle and Calves Waste Emissions | 280502          | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Dairy Cattle                      | 280501          | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Goats                             | 2805045         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Horses and Ponies                 | 2805035         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Poultry                           | 2805030         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Sheep and Lambs                   | 2805040         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Swine                             | 2805025         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Catastrophic/Accidental Releases                                   | 2830            | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Domestic Animals Waste Emissions                                   | 2806            | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Wild Animals Waste Emissions                                       | 2807            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Aircraft   | 2275            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Highway Vehicles-Diesel  | 2230            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | POINT    |                 | 0                | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | POINT    |                 | 0                | 100.0              |
| Natural Sources, Biogenic   | 2701            | BIOGENIC |                 | 0                | 100.0              |
| Natural Sources, Geogenic   | 2730            | GEOGENIC |                 | 0                | 100.0              |
| Petroleum and Petroleum Product Storage & Transport-Other                                     | 250             | AREA     |                 | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Dry Cleaning  | 410             | POINT    |                 | 0                | 100.0              |
| Rubber/Plastics   | 2430000000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Dry Cleaning  | 2420            | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Industrial  | 2440020000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Commercial                                  | 24610 - 24      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465            | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465000000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer and Commercial                     | 24600 - 24      | AREA     |                 | 0                | 100.0              |
| Stationary Source Fuel Combustion-Electric Utility  | 2101            | AREA     |                 | 0                | 100.0              |
| Traffic Markings  | 2401008000      | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills   | 2620            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills   | 2620            | POINT    |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Leaking Underground Storage Tanks                     | 2660            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-TSDFs   | 2640            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Wastewater Treatment                                  | 2630            | AREA     |                 | 0                | 100.0              |
| <b>Totals for All Categories</b>  |                 |          | 2,687,169       | 100              |                    |

**Table A-5. Summary of Annual PM10-PRI and PM25-PRI Emissions for the CENRAP Region by Category, Sector, and Pollutant: Base B Inventory**

| Category  | Category Number | Sector   | PM10-PRI  |                  |                    | PM25-PRI  |                  |                    |
|---|-----------------|----------|-----------|------------------|--------------------|-----------|------------------|--------------------|
|   |                 |          | Tons/Year | Percent of Total | Cumulative Percent | Tons/Year | Percent of Total | Cumulative Percent |
| Mobile Sources-Unpaved Roads  | 2296            | AREA     | 3,870,203 | 50.73            | 50.73              | 578,858   | 31.42            | 31.42              |
| Miscellaneous Area Sources-Agricultural Production-Crops                | 2801            | AREA     | 1,465,743 | 19.21            | 69.94              | 298,347   | 16.19            | 47.61              |
| Industrial Processes-Construction: SIC 15-17                            | 2311            | AREA     | 528,340   | 6.93             | 76.87              | 105,681   | 5.74             | 53.35              |
| Mobile Sources-Paved Roads  | 2294            | AREA     | 474,726   | 6.22             | 83.09              | 76,380    | 4.15             | 57.5               |
| Industrial Processes-Mining and Quarrying: SIC 14                       | 2325            | AREA     | 183,304   | 2.4              | 85.49              | 36,660    | 1.99             | 59.49              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Field Burning  | 28015           | AREA     | 175,202   | 2.3              | 87.79              | 138,145   | 7.5              | 66.99              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Beef Cattle | 280500          | AREA     | 96,895    | 1.27             | 89.06              | 14,534    | 0.79             | 67.78              |
| Miscellaneous Area Sources-Other Combustion                             | 2810            | AREA     | 83,356    | 1.09             | 90.15              | 71,092    | 3.86             | 71.64              |
| External Combustion Boilers-Electric Generation                         | 1010            | POINT    | 72,057    | 0.94             | 91.09              | 47,369    | 2.57             | 74.21              |
| Miscellaneous Area Sources-Other Combustion                             | 2810            | POINT    | 63,909    | 0.84             | 91.93              | 54,160    | 2.94             | 77.15              |
| Industrial Processes-Food and Agriculture                               | 302             | POINT    | 60,785    | 0.8              | 92.73              | 11,460    | 0.62             | 77.77              |
| Stationary Source Fuel Combustion-Residential                           | 2104            | AREA     | 57,225    | 0.75             | 93.48              | 57,036    | 3.1              | 80.87              |
| Open Burning-Waste Disposal, Treatment, and Recovery                    | 261             | AREA     | 54,806    | 0.72             | 94.2               | 52,111    | 2.83             | 83.7               |
| External Combustion Boilers-Industrial                                  | 1020            | POINT    | 47,521    | 0.62             | 94.82              | 40,584    | 2.2              | 85.9               |
| Stationary Source Fuel Combustion-Industrial                            | 2102            | AREA     | 47,280    | 0.62             | 95.44              | 17,361    | 0.94             | 86.84              |
| Mobile Sources-Off-highway Vehicle Diesel                               | 2270            | NONROAD  | 43,478    | 0.57             | 96.01              | 40,576    | 2.2              | 89.04              |
| Industrial Processes-Mineral Products                                   | 305             | POINT    | 35,961    | 0.47             | 96.48              | 14,426    | 0.78             | 89.82              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                 | 2810020         | AREA     | 32,949    | 0.43             | 96.91              | 27,910    | 1.51             | 91.33              |
| Natural Sources, Geogenic   | 2730            | GEOGENIC | 32,164    | 0.42             | 97.33              | 7,076     | 0.38             | 91.71              |
| Mobile Sources-Highway Vehicles-Diesel                                  | 2230            | ON-ROAD  | 23,157    | 0.3              | 97.63              | 19,984    | 1.08             | 92.79              |
| Mobile Sources-Pleasure Craft   | 2282            | NONROAD  | 20,637    | 0.27             | 97.9               | 19,085    | 1.04             | 93.83              |
| Industrial Processes-Food and Kindred Products: SIC 20                  | 2302            | AREA     | 15,078    | 0.2              | 98.1               | 14,041    | 0.76             | 94.59              |
| Mobile Sources-Highway Vehicles-Gasoline                                | 2201            | ON-ROAD  | 14,492    | 0.19             | 98.29              | 7,247     | 0.39             | 94.98              |
| Industrial Processes-Primary Metal Production                           | 303             | POINT    | 13,492    | 0.18             | 98.47              | 3,183     | 0.17             | 95.15              |
| Internal Combustion Engines-Industrial                                  | 2020            | POINT    | 13,373    | 0.18             | 98.65              | 13,064    | 0.71             | 95.86              |
| Industrial Processes-Chemical Manufacturing                             | 301             | POINT    | 13,220    | 0.17             | 98.82              | 10,340    | 0.56             | 96.42              |
| Industrial Processes-Petroleum Industry                                 | 306             | POINT    | 12,597    | 0.17             | 98.99              | 10,358    | 0.56             | 96.98              |
| Industrial Processes-Pulp and Paper and Wood Products                   | 307             | POINT    | 12,382    | 0.16             | 99.15              | 7,219     | 0.39             | 97.37              |
| Mobile Sources-Railroad Equipment                                       | 2285            | NONROAD  | 8,991     | 0.12             | 99.27              | 8,110     | 0.44             | 97.81              |
| Stationary Source Fuel Combustion-Commercial/Institutional              | 2103            | AREA     | 6,937     | 0.09             | 99.36              | 6,543     | 0.36             | 98.17              |
| Industrial Processes-Cooling Tower                                      | 3850            | POINT    | 6,403     | 0.08             | 99.44              | 5,469     | 0.3              | 98.47              |

**Table A-5 (continued)**

| Category  | Category Number | Sector  | PM10-PRI  |                  |                    | PM25-PRI  |                  |                    |
|---|-----------------|---------|-----------|------------------|--------------------|-----------|------------------|--------------------|
|   |                 |         | Tons/Year | Percent of Total | Cumulative Percent | Tons/Year | Percent of Total | Cumulative Percent |
| Industrial Processes-Secondary Metal Production                               | 304             | POINT   | 6,103     | 0.08             | 99.52              | 3,804     | 0.21             | 98.68              |
| Mobile Sources-Off-highway Vehicle Gasoline, 2-Stroke                         | 2260            | NONROAD | 5,586     | 0.07             | 99.59              | 5,171     | 0.28             | 98.96              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Tilling & Harvesting | 28010           | AREA    | 3,626     | 0.05             | 99.64              | 96        | 0.01             | 98.97              |
| Industrial Processes-Miscellaneous Manufacturing Industries                   | 399             | POINT   | 3,310     | 0.04             | 99.68              | 1,922     | 0.1              | 99.07              |
| Internal Combustion Engines-Electric Generation                               | 2010            | POINT   | 3,271     | 0.04             | 99.72              | 3,177     | 0.17             | 99.24              |
| Industrial Processes-In-process Fuel Use                                      | 390             | POINT   | 3,264     | 0.04             | 99.76              | 1,187     | 0.06             | 99.3               |
| Industrial Processes-Industrial Processes: NEC                                | 2399            | AREA    | 2,815     | 0.04             | 99.8               | 1,950     | 0.11             | 99.41              |
| Mobile Sources-Marine Vessels, Commercial                                     | 2280            | NONROAD | 2,798     | 0.04             | 99.84              | 2,574     | 0.14             | 99.55              |
| External Combustion Boilers-Commercial/Institutional                          | 1030            | POINT   | 1,587     | 0.02             | 99.86              | 1,048     | 0.06             | 99.61              |
| Industrial Processes-Fabricated Metal Products                                | 309             | POINT   | 1,235     | 0.02             | 99.88              | 490       | 0.03             | 99.64              |
| Petroleum and Solvent Evaporation-Surface Coating Operations                  | 402             | POINT   | 1,186     | 0.02             | 99.9               | 978       | 0.05             | 99.69              |
| Waste Disposal-Solid Waste Disposal-Government                                | 501             | POINT   | 976       | 0.01             | 99.91              | 507       | 0.03             | 99.72              |
| Waste Disposal, Treatment, and Recovery-On-site Incineration                  | 2601            | AREA    | 935       | 0.01             | 99.92              | 664       | 0.04             | 99.76              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                         | 2265            | NONROAD | 756       | 0.01             | 99.93              | 707       | 0.04             | 99.8               |
| Industrial Processes-Rubber and Miscellaneous Plastics Products               | 308             | POINT   | 604       | 0.01             | 99.94              | 254       | 0.01             | 99.81              |
| Mobile Sources-Aircraft   | 2275            | NONROAD | 441       | 0.01             | 99.95              | 349       | 0.02             | 99.83              |
| Waste Disposal-Solid Waste Disposal-Industrial                                | 503             | POINT   | 438       | 0.01             | 99.96              | 302       | 0.02             | 99.85              |
| Industrial Processes-Oil and Gas Production                                   | 310             | POINT   | 433       | 0.01             | 99.97              | 413       | 0.02             | 99.87              |
| Petroleum and Petroleum Product Storage & Transport-Other                     | 250             | AREA    | 387       | 0.01             | 99.98              | 387       | 0.02             | 99.89              |
| Waste Disposal-Solid Waste Disposal-Commercial/Institutional                  | 502             | POINT   | 275       | 0                | 99.98              | 173       | 0.01             | 99.9               |
| Industrial Processes-Machinery, Miscellaneous                                 | 3129            | POINT   | 258       | 0                | 99.98              | 215       | 0.01             | 99.91              |
| Internal Combustion Engines-Commercial/Institutional                          | 2030            | POINT   | 214       | 0                | 99.98              | 214       | 0.01             | 99.92              |
| Mobile Sources-LPG  | 2267            | NONROAD | 190       | 0                | 99.98              | 188       | 0.01             | 99.93              |
| Mobile Sources-Aircraft   | 2275            | POINT   | 160       | 0                | 99.98              | 113       | 0.01             | 99.94              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                       | 2810020         | POINT   | 158       | 0                | 99.98              | 126       | 0.01             | 99.95              |
| Miscellaneous Area Sources-Catastrophic/Accidental Releases                   | 2830            | AREA    | 131       | 0                | 99.98              | 131       | 0.01             | 99.96              |
| MACT Source Categories : Vinyl-based Resins                                   | 6463            | POINT   | 118       | 0                | 99.98              | 77        | 0                | 99.96              |
| Waste Disposal-Site Remediation   | 504             | POINT   | 102       | 0                | 99.98              | 65        | 0                | 99.96              |
| Solvent Utilization-Miscellaneous Non-industrial: Commercial                  | 24610 - 24      | AREA    | 91        | 0                | 99.98              | 91        | 0                | 99.96              |
| Internal Combustion Engines-Engine Testing                                    | 2040            | POINT   | 61        | 0                | 99.98              | 55        | 0                | 99.96              |
| Petroleum and Solvent Evaporation-Organic Solvent Evaporation                 | 401             | POINT   | 57        | 0                | 99.98              | 40        | 0                | 99.96              |
| Bulk Materials Transport & Transport  | 253             | AREA    | 56        | 0                | 99.98              | 56        | 0                | 99.96              |
| Internal Combustion Engines-Fugitive Emissions                                | 2888            | POINT   | 49        | 0                | 99.98              | 47        | 0                | 99.96              |

**Table A-5 (continued)**

| Category   | Category Number | Sector  | PM10-PRI  |                  |                    | PM25-PRI  |                  |                    |
|--|-----------------|---------|-----------|------------------|--------------------|-----------|------------------|--------------------|
|  |                 |         | Tons/Year | Percent of Total | Cumulative Percent | Tons/Year | Percent of Total | Cumulative Percent |
| Industrial Processes-Transportation Equipment  | 314             | POINT   | 46        | 0                | 99.98              | 28        | 0                | 99.96              |
| Petroleum and Solvent Evaporation-Printing/Publishing                                | 405             | POINT   | 41        | 0                | 99.98              | 34        | 0                | 99.96              |
| Petroleum and Solvent Evaporation-Organic Chemical Storage                           | 407             | POINT   | 40        | 0                | 99.98              | 33        | 0                | 99.96              |
| Mobile Sources-CNG   | 2268            | NONROAD | 39        | 0                | 99.98              | 38        | 0                | 99.96              |
| External Combustion Boilers-Space Heaters  | 1050            | POINT   | 36        | 0                | 99.98              | 35        | 0                | 99.96              |
| Petroleum and Solvent Evaporation-Transportation and Marketing of Petroleum Products | 406             | POINT   | 30        | 0                | 99.98              | 25        | 0                | 99.96              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Dairy Cattle             | 280501          | AREA    | 26        | 0                | 99.98              | 3         | 0                | 99.96              |
| Industrial Processes-Electrical Equipment  | 313             | POINT   | 23        | 0                | 99.98              | 21        | 0                | 99.96              |
| Mobile Sources-Unpaved Roads   | 2296            | POINT   | 21        | 0                | 99.98              | 21        | 0                | 99.96              |
| Mobile Sources-Off-highway Vehicle Diesel  | 2270            | POINT   | 12        | 0                | 99.98              | 11        | 0                | 99.96              |
| Industrial Processes-Leather and Leather Products                                    | 3209            | POINT   | 7         | 0                | 99.98              | 2         | 0                | 99.96              |
| Petroleum and Solvent Evaporation-Petroleum Product Storage at Refineries            | 403             | POINT   | 7         | 0                | 99.98              | 6         | 0                | 99.96              |
| Industrial Processes-Building Construction   | 3110            | POINT   | 5         | 0                | 99.98              | 1         | 0                | 99.96              |
| MACT Source Categories-Miscellaneous Processes                                       | 6824            | POINT   | 4         | 0                | 99.98              | 1         | 0                | 99.96              |
| Petroleum and Solvent Evaporation-Petroleum Liquids Storage (non-Refinery)           | 4040            | POINT   | 3         | 0                | 99.98              | 3         | 0                | 99.96              |
| Petroleum and Solvent Evaporation-Organic Chemical Transportation                    | 4089            | POINT   | 3         | 0                | 99.98              | 2         | 0                | 99.96              |
| MACT Source Categories : Styrene or Methacrylate Based Resins                        | 6413            | POINT   | 2         | 0                | 99.98              | 1         | 0                | 99.96              |
| Industrial Processes-Textile Products  | 330             | POINT   | 2         | 0                | 99.98              | 2         | 0                | 99.96              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                                | 2265            | POINT   | 2         | 0                | 99.98              | 2         | 0                | 99.96              |
| Mobile Sources-Paved Roads   | 2294            | POINT   | 1         | 0                | 99.98              | 1         | 0                | 99.96              |
| Miscellaneous Area Sources-Aircraft/Rocket Engine Firing and Testing                 | 2810040         | AREA    | 1         | 0                | 99.98              |           | 0                | 99.96              |
| MACT Source Categories : Agricultural Chemicals Production                           | 631             | POINT   | 0         | 0                | 100.0              | 0         | 0                | 99.96              |
| Industrial Processes-Printing and Publishing   | 3600            | POINT   | 0         | 0                | 100.0              | 0         | 0                | 99.96              |
| Industrial Processes-Photo Equip/Health Care/Labs/Air Condit/SwimPools               | 3150            | POINT   | 0         | 0                | 100.0              | 0         | 0                | 99.96              |
| Petroleum and Solvent Evaporation : Organic Chemical Transportation                  | 4088            | POINT   | 0         | 0                | 100.0              | 0         | 0                | 99.96              |
| Internal Combustion Engines-Off-highway Diesel Engines                               | 2700            | POINT   | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| MACT Source Categories : Cellulose-based Resins                                      | 644             | POINT   | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| MACT Source Categories : Consumer Product Manufacturing Facilities                   | 6818            | POINT   | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| MACT Source Categories : Food and Agricultural Processes                             | 6258            | POINT   | 0         | 0                | 100.0              | 0         | 0                | 100.0              |

**Table A-5 (continued)**

| Category  | Category Number | Sector   | PM10-PRI  |                  |                    | PM25-PRI  |                  |                    |
|---|-----------------|----------|-----------|------------------|--------------------|-----------|------------------|--------------------|
|   |                 |          | Tons/Year | Percent of Total | Cumulative Percent | Tons/Year | Percent of Total | Cumulative Percent |
| MACT Source Categories-Inorganic Chemicals Manufacturing                                      | 6513            | POINT    | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes  | 6828            | POINT    | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes (Chemicals)                                    | 6848            | POINT    | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Resins   | 6452            | POINT    | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills   | 2620            | POINT    | 0         | 0                | 100.0              | 0         | 0                | 100.0              |
| Architectural Coatings  | 2401001000      | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Auto Refinishing  | 2401005000      | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Degreasing  | 2415            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Gas Marketing Stage I   | 25010600        | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Graphic Arts  | 2425            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Industrial Processes-Oil and Gas Production: SIC 13   | 2310            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Industrial Surface Coating  | 2401015000      | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Inorganic Chemical Storage & Transport  | 252             | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Cattle and Calves Waste Emissions | 280502          | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Goats                             | 2805045         | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Horses and Ponies                 | 2805035         | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Poultry                           | 2805030         | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Sheep and Lambs                   | 2805040         | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Swine                             | 2805025         | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Domestic Animals Waste Emissions                                   | 2806            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Miscellaneous Area Sources-Wild Animals Waste Emissions                                       | 2807            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Mobile Sources-Aircraft   | 2275            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Mobile Sources-Highway Vehicles-Diesel  | 2230            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Natural Sources, Biogenic   | 2701            | BIOGENIC |           | 0                | 100.0              |           | 0                | 100.0              |
| Petroleum and Solvent Evaporation-  | 4250            | POINT    |           | 0                | 100.0              |           | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Dry Cleaning  | 410             | POINT    |           | 0                | 100.0              |           | 0                | 100.0              |
| Rubber/Plastics   | 2430000000      | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Solvent Utilization-Dry Cleaning  | 2420            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Industrial  | 2440020000      | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                                    | 2465000000      | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer and Commercial                     | 24600 - 24      | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |
| Stationary Source Fuel Combustion-Electric Utility  | 2101            | AREA     |           | 0                | 100.0              |           | 0                | 100.0              |



**Table A-5 (continued)**

| Category  | Category Number | Sector | PM10-PRI  |                  |                    | PM25-PRI  |                  |                    |
|---|-----------------|--------|-----------|------------------|--------------------|-----------|------------------|--------------------|
|   |                 |        | Tons/Year | Percent of Total | Cumulative Percent | Tons/Year | Percent of Total | Cumulative Percent |
| Traffic Markings  | 2401008000      | AREA   |           | 0                | 100.0              |           | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills                         | 2620            | AREA   |           | 0                | 100.0              |           | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Leaking Underground Storage Tanks | 2660            | AREA   |           | 0                | 100.0              |           | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-TSDFs                             | 2640            | AREA   |           | 0                | 100.0              |           | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Wastewater Treatment              | 2630            | AREA   |           | 0                | 100.0              |           | 0                | 100.0              |
| <b>Totals for All Categories</b>  |                 |        | 7,628,680 | 100              |                    | 1,842,252 | 100              |                    |

**Table A-6. Summary of Annual NH<sub>3</sub> Emissions for the CENRAP Region by Category, Sector, and Pollutant: Base B Inventory**

| Category  | Category Number | Sector   | NH <sub>3</sub> |                  |                    |
|---|-----------------|----------|-----------------|------------------|--------------------|
|   |                 |          | Tons/Year       | Percent of Total | Cumulative Percent |
| Miscellaneous Area Sources-Agricultural Production-Crops                                      | 2801            | AREA     | 561,194         | 31.94            | 31.94              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Cattle and Calves Waste Emissions | 280502          | AREA     | 243,489         | 13.86            | 45.8               |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Swine                             | 2805025         | AREA     | 187,598         | 10.68            | 56.48              |
| Industrial Processes-Food and Agriculture   | 302             | POINT    | 158,370         | 9.01             | 65.49              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Poultry                           | 2805030         | AREA     | 138,222         | 7.87             | 73.36              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Beef Cattle                       | 280500          | AREA     | 118,941         | 6.77             | 80.13              |
| Mobile Sources-Highway Vehicles-Gasoline  | 2201            | ON-ROAD  | 48,820          | 2.78             | 82.91              |
| Natural Sources, Biogenic   | 2701            | BIOGENIC | 44,688          | 2.54             | 85.45              |
| Miscellaneous Area Sources-Domestic Animals Waste Emissions                                   | 2806            | AREA     | 36,178          | 2.06             | 87.51              |
| Industrial Processes-Industrial Processes: NEC  | 2399            | AREA     | 33,960          | 1.93             | 89.44              |
| Miscellaneous Area Sources-Other Combustion   | 2810            | AREA     | 32,051          | 1.82             | 91.26              |
| Miscellaneous Area Sources-Wild Animals Waste Emissions                                       | 2807            | AREA     | 23,443          | 1.33             | 92.59              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Field Burning                        | 28015           | AREA     | 22,612          | 1.29             | 93.88              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Dairy Cattle                      | 280501          | AREA     | 22,407          | 1.28             | 95.16              |
| Industrial Processes-Chemical Manufacturing   | 301             | POINT    | 13,390          | 0.76             | 95.92              |
| Industrial Processes-Food and Kindred Products: SIC 20  | 2302            | AREA     | 12,727          | 0.72             | 96.64              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Horses and Ponies                 | 2805035         | AREA     | 10,750          | 0.61             | 97.25              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Goats                             | 2805045         | AREA     | 8,483           | 0.48             | 97.73              |
| Miscellaneous Area Sources-Other Combustion   | 2810            | POINT    | 6,116           | 0.35             | 98.08              |
| Waste Disposal-Solid Waste Disposal-Commercial/Institutional                                  | 502             | POINT    | 4,521           | 0.26             | 98.34              |
| Miscellaneous Area Sources-Agriculture Production-Livestock-Sheep and Lambs                   | 2805040         | AREA     | 4,247           | 0.24             | 98.58              |
| External Combustion Boilers-Electric Generation   | 1010            | POINT    | 4,172           | 0.24             | 98.82              |
| External Combustion Boilers-Space Heaters   | 1050            | POINT    | 3,752           | 0.21             | 99.03              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                                       | 2810020         | AREA     | 3,343           | 0.19             | 99.22              |
| Waste Disposal, Treatment, and Recovery-Wastewater Treatment                                  | 2630            | AREA     | 3,216           | 0.18             | 99.4               |
| Stationary Source Fuel Combustion-Industrial  | 2102            | AREA     | 1,951           | 0.11             | 99.51              |
| Mobile Sources-Highway Vehicles-Diesel  | 2230            | ON-ROAD  | 1,497           | 0.09             | 99.6               |
| Waste Disposal, Treatment, and Recovery-Landfills   | 2620            | AREA     | 1,061           | 0.06             | 99.66              |
| Industrial Processes-Pulp and Paper and Wood Products   | 307             | POINT    | 1,015           | 0.06             | 99.72              |
| Industrial Processes-Petroleum Industry   | 306             | POINT    | 1,003           | 0.06             | 99.78              |
| Waste Disposal-Solid Waste Disposal-Government  | 501             | POINT    | 974             | 0.06             | 99.84              |
| Mobile Sources-CNG  | 2268            | NONROAD  | 838             | 0.05             | 99.89              |
| Stationary Source Fuel Combustion-Commercial/Institutional                                    | 2103            | AREA     | 307             | 0.02             | 99.91              |
| Industrial Processes-Mineral Products   | 305             | POINT    | 249             | 0.01             | 99.92              |
| Mobile Sources-Off-highway Vehicle Diesel   | 2270            | NONROAD  | 217             | 0.01             | 99.93              |
| External Combustion Boilers-Commercial/Institutional  | 1030            | POINT    | 209             | 0.01             | 99.94              |
| Internal Combustion Engines-Electric Generation   | 2010            | POINT    | 164             | 0.01             | 99.95              |
| Mobile Sources-Railroad Equipment   | 2285            | NONROAD  | 147             | 0.01             | 99.96              |
| External Combustion Boilers-Industrial  | 1020            | POINT    | 142             | 0.01             | 99.97              |
| Petroleum and Solvent Evaporation-Organic Chemical Storage                                    | 407             | POINT    | 126             | 0.01             | 99.98              |
| Stationary Source Fuel Combustion-Residential   | 2104            | AREA     | 91              | 0.01             | 99.99              |
| Waste Disposal-Solid Waste Disposal-Industrial  | 503             | POINT    | 87              | 0                | 99.99              |

**Table A-6 (continued)**

| Category   | Category Number | Sector  | NH <sub>3</sub> |                  |                    |
|--|-----------------|---------|-----------------|------------------|--------------------|
|  |                 |         | Tons/Year       | Percent of Total | Cumulative Percent |
| Mobile Sources-Pleasure Craft  | 2282            | NONROAD | 79              | 0                | 99.99              |
| Internal Combustion Engines-Industrial   | 2020            | POINT   | 62              | 0                | 100.0              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                                | 2265            | NONROAD | 37              | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Landfills                                    | 2620            | POINT   | 36              | 0                | 100.0              |
| Mobile Sources-Marine Vessels, Commercial  | 2280            | NONROAD | 32              | 0                | 100.0              |
| Inorganic Chemical Storage & Transport   | 252             | AREA    | 22              | 0                | 100.0              |
| Industrial Processes-Miscellaneous Manufacturing Industries                          | 399             | POINT   | 19              | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Surface Coating Operations                         | 402             | POINT   | 16              | 0                | 100.0              |
| Miscellaneous Area Sources-Prescribed Rangeland Burning                              | 2810020         | POINT   | 16              | 0                | 100.0              |
| Mobile Sources-Off-highway Vehicle Gasoline, 2-Stroke                                | 2260            | NONROAD | 15              | 0                | 100.0              |
| Industrial Processes-Rubber and Miscellaneous Plastics Products                      | 308             | POINT   | 14              | 0                | 100.0              |
| Industrial Processes-Secondary Metal Production                                      | 304             | POINT   | 4               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Petroleum Product Storage at Refineries            | 403             | POINT   | 3               | 0                | 100.0              |
| Industrial Processes-In-process Fuel Use   | 390             | POINT   | 2               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Organic Solvent Evaporation                        | 401             | POINT   | 1               | 0                | 100.0              |
| Industrial Processes-Electrical Equipment  | 313             | POINT   | 1               | 0                | 100.0              |
| MACT Source Categories : Vinyl-based Resins  | 6463            | POINT   | 1               | 0                | 100.0              |
| Stationary Source Fuel Combustion-Electric Utility                                   | 2101            | AREA    | 1               | 0                | 100.0              |
| Industrial Processes-Oil and Gas Production  | 310             | POINT   | 0               | 0                | 100.0              |
| Mobile Sources-Aircraft  | 2275            | NONROAD | 0               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Organic Chemical Transportation                    | 4089            | POINT   | 0               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Transportation and Marketing of Petroleum Products | 406             | POINT   | 0               | 0                | 100.0              |
| Industrial Processes-Fabricated Metal Products                                       | 309             | POINT   | 0               | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Printing/Publishing                                | 405             | POINT   | 0               | 0                | 100.0              |
| Internal Combustion Engines-Engine Testing   | 2040            | POINT   | 0               | 0                | 100.0              |
| Internal Combustion Engines-Commercial/Institutional                                 | 2030            | POINT   | 0               | 0                | 100.0              |
| Industrial Processes-Photo Equip/Health Care/Labs/Air Condit/Swim Pools              | 3150            | POINT   | 0               | 0                | 100.0              |
| Industrial Processes-Primary Metal Production  | 303             | POINT   | 0               | 0                | 100.0              |
| Internal Combustion Engines-Fugitive Emissions                                       | 2888            | POINT   | 0               | 0                | 100.0              |
| Mobile Sources-LPG   | 2267            | NONROAD | 0               | 0                | 100.0              |
| Architectural Coatings   | 2401001000      | AREA    |                 | 0                | 100.0              |
| Auto Refinishing   | 2401005000      | AREA    |                 | 0                | 100.0              |
| Bulk Materials Transport & Transport   | 253             | AREA    |                 | 0                | 100.0              |
| Degreasing   | 2415            | AREA    |                 | 0                | 100.0              |
| Gas Marketing Stage I  | 25010600        | AREA    |                 | 0                | 100.0              |
| Graphic Arts   | 2425            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Building Construction   | 3110            | POINT   |                 | 0                | 100.0              |
| Industrial Processes-Construction: SIC 15-17   | 2311            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Cooling Tower   | 3850            | POINT   |                 | 0                | 100.0              |
| Industrial Processes-Leather and Leather Products                                    | 3209            | POINT   |                 | 0                | 100.0              |
| Industrial Processes-Machinery, Miscellaneous  | 3129            | POINT   |                 | 0                | 100.0              |
| Industrial Processes-Mining and Quarrying: SIC 14                                    | 2325            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Oil and Gas Production: SIC 13                                  | 2310            | AREA    |                 | 0                | 100.0              |
| Industrial Processes-Printing and Publishing   | 3600            | POINT   |                 | 0                | 100.0              |
| Industrial Processes-Textile Products  | 330             | POINT   |                 | 0                | 100.0              |
| Industrial Processes-Transportation Equipment  | 314             | POINT   |                 | 0                | 100.0              |
| Industrial Surface Coating   | 2401015000      | AREA    |                 | 0                | 100.0              |
| Internal Combustion Engines-Off-highway Diesel Engines                               | 2700            | POINT   |                 | 0                | 100.0              |
| MACT Source Categories : Agricultural Chemicals Production                           | 631             | POINT   |                 | 0                | 100.0              |
| MACT Source Categories : Cellulose-based Resins                                      | 644             | POINT   |                 | 0                | 100.0              |

**Table A-6 (continued)**

| Category  | Category Number | Sector   | NH <sub>3</sub> |                  |                    |
|---|-----------------|----------|-----------------|------------------|--------------------|
|   |                 |          | Tons/Year       | Percent of Total | Cumulative Percent |
| MACT Source Categories : Consumer Product Manufacturing Facilities            | 6818            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories : Food and Agricultural Processes                      | 6258            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories : Styrene or Methacrylate Based Resins                 | 6413            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Inorganic Chemicals Manufacturing                      | 6513            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes                                | 6824            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes                                | 6828            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Processes (Chemicals)                    | 6848            | POINT    |                 | 0                | 100.0              |
| MACT Source Categories-Miscellaneous Resins                                   | 6452            | POINT    |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Agricultural Production-Crops-Tilling & Harvesting | 28010           | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Aircraft/Rocket Engine Firing and Testing          | 2810040         | AREA     |                 | 0                | 100.0              |
| Miscellaneous Area Sources-Catastrophic/Accidental Releases                   | 2830            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Aircraft   | 2275            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Aircraft   | 2275            | POINT    |                 | 0                | 100.0              |
| Mobile Sources-Highway Vehicles-Diesel  | 2230            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Off-highway Vehicle Diesel                                     | 2270            | POINT    |                 | 0                | 100.0              |
| Mobile Sources-Off-highway Vehicle Gasoline, 4-Stroke                         | 2265            | POINT    |                 | 0                | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Paved Roads  | 2294            | POINT    |                 | 0                | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | AREA     |                 | 0                | 100.0              |
| Mobile Sources-Unpaved Roads  | 2296            | POINT    |                 | 0                | 100.0              |
| Natural Sources, Geogenic   | 2730            | GEOGENIC |                 | 0                | 100.0              |
| Open Burning-Waste Disposal, Treatment, and Recovery                          | 261             | AREA     |                 | 0                | 100.0              |
| Petroleum and Petroleum Product Storage & Transport-Other                     | 250             | AREA     |                 | 0                | 100.0              |
| Petroleum and Solvent Evaporation-  | 4250            | POINT    |                 | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Dry Cleaning                              | 410             | POINT    |                 | 0                | 100.0              |
| Petroleum and Solvent Evaporation : Organic Chemical Transportation           | 4088            | POINT    |                 | 0                | 100.0              |
| Petroleum and Solvent Evaporation-Petroleum Liquids Storage (non-Refinery)    | 4040            | POINT    |                 | 0                | 100.0              |
| Rubber/Plastics   | 2430000000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Dry Cleaning  | 2420            | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Industrial                                  | 2440020000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Commercial                  | 24610 - 24      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                    | 2465            | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer                    | 2465000000      | AREA     |                 | 0                | 100.0              |
| Solvent Utilization-Miscellaneous Non-industrial: Consumer and Commercial     | 24600 - 24      | AREA     |                 | 0                | 100.0              |
| Traffic Markings  | 2401008000      | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-Leaking Underground Storage Tanks     | 2660            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-On-site Incineration                  | 2601            | AREA     |                 | 0                | 100.0              |
| Waste Disposal, Treatment, and Recovery-TSDFs                                 | 2640            | AREA     |                 | 0                | 100.0              |
| Waste Disposal-Site Remediation   | 504             | POINT    |                 | 0                | 100.0              |
| <b>Totals for All Categories</b>  |                 |          | 1,757,129       | 100              |                    |

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